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A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY A. S. RUSSELL, M.C., D.Sc.

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No. 6. JUNE 1920

CONTENTS

PRICE 6d. NET

EDITORIAL NOTES		163
ORIGIN OF THE VEGETATION OF THE LAND	Prof. A. C. Seward	166
ST. FRANCIS OF ASSISI	A. G. Little	168
FLYING—AND ITS OUTLOOK FROM A POSTAL TELEGRAPH POINT OF VIEW	A. S. Baxendale	172
CORRESPONDENCE		174
THE DISCOVERIES IN CRETE	George Glasgow	176
IMMUNITY AND PLANT DISEASES	Geo. C. Gough	179
THE REVIVAL OF LEARNING AND THE CAPTURE OF CONSTANTINOPLE	R. B. Mowat	180
THE ORIGINS OF MEXICAN MYTHOLOGY	Lewis Spence	182
AERIAL WARFARE IN ANCIENT INDIA	Ikbal Ali Shah	185
THE MODERN USES OF RUBBER		186
REVIEWS OF BOOKS		189

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Editorial Notes

An interesting description of the Air Routes of the Empire was given recently before the Royal Geographical Society by Major-General Sir Frederick Sykes, Controller-General of Civil Aviation, and by the courtesy of the Editor of the Society's publication, the *Geographical Journal*, we are allowed to give some notes on the lecture, and to reproduce some of the sketch-maps shown.

* * * * *

In considering the general development of Imperial air routes, one of the first things that appears is that for some time to come Egypt must be the "hub" of the India, Australia, and Cape routes. It is, in Sir Frederick Sykes' phrase, the Clapham Junction of air routes. Our own country, being, so to speak, on the edge of a continent, is barred geographically from occupying this position; and furthermore our climate, and especially our fogs, tend to hinder successful flying. Fortunately, however, parts of the Empire are wonderfully wisely distributed over the surface of the earth, so that unequalled positions for the establishments of depots, fuel bases, and for meteorological and wireless stations are at hand in almost every part of the world.

* * * * *

It is clear that, before an air route is established between two places, the ground between must be carefully gone over and sites for depots chosen. These sites must be very carefully selected and equipped, so that an airman may get what he requires on his journey. Routes must be selected which involve the least risk to the flyer. Mountainous country and very large stretches of sea, for example, should be avoided, if that be possible. It is also expedient, if circumstances allow, to avoid flying over foreign lands unless a perfectly good understanding about the matter exists. In Europe, of course, an all-red route is impossible.

In the past two or three years the preliminary work has been done, the routes have been selected, depots and aerodromes have been stationed along the routes, and many of the suggested journeys have been successfully flown.

* * * * *

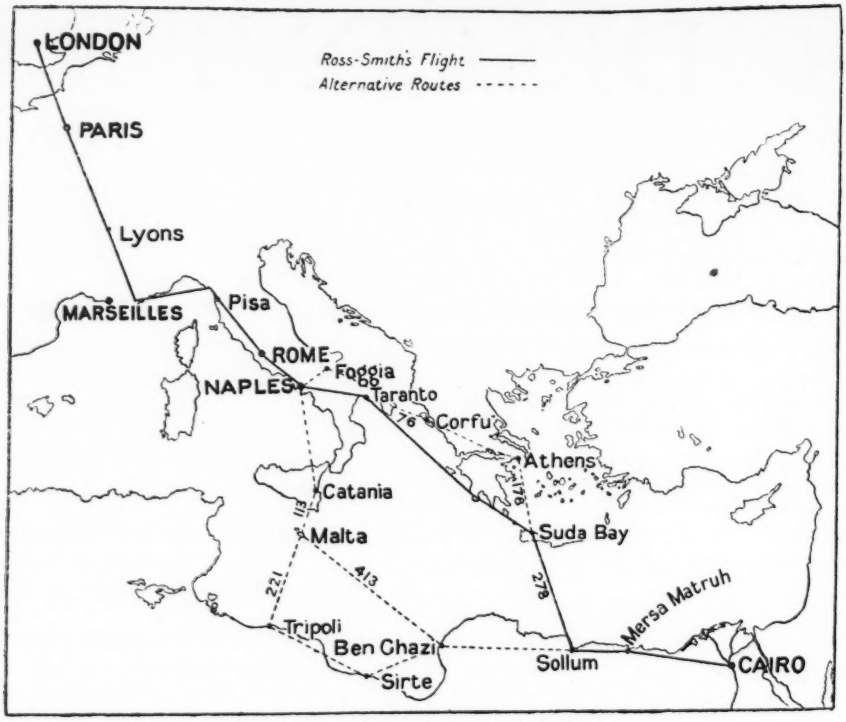
Let us next consider the actual air routes themselves. The journey from England to Egypt was first accomplished in November 1918, by Generals Borton and Salmond. Although it has been flown many times in the past two years, it is by no means an easy journey. The accompanying map shows the route clearly. The continuous line is the course taken by Sir M. Ross-Smith, the dotted lines suggest alternative routes. The numbers refer to distances over the sea in statute miles.

* * * * *

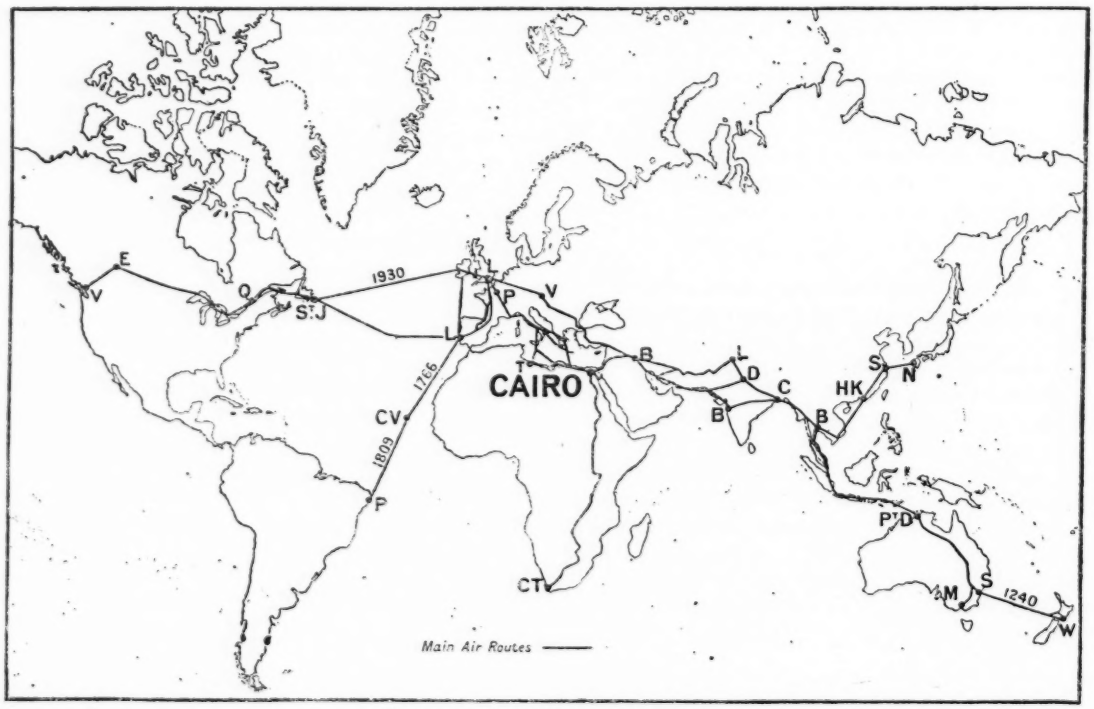
The journey between Egypt and India is very quick by air, and a comparison of the times of transit by sea and air is very interesting. From Cairo to Karachi the journey by air occupies four days, flying by daylight only, while by sea from Port Said to Bombay the journey takes nine days. Between Cairo and Baghdad the journey by air takes twelve hours only; by the existing sea route the time taken is about three weeks. In the second map the air route taken by Ross-Smith is shown, and alternative routes are indicated.

* * * * *

Once in India, there are several ways at the airman's disposal in the trans-Indian journey. From Karachi



MAP 1.—AIR ROUTES, LONDON TO CAIRO.



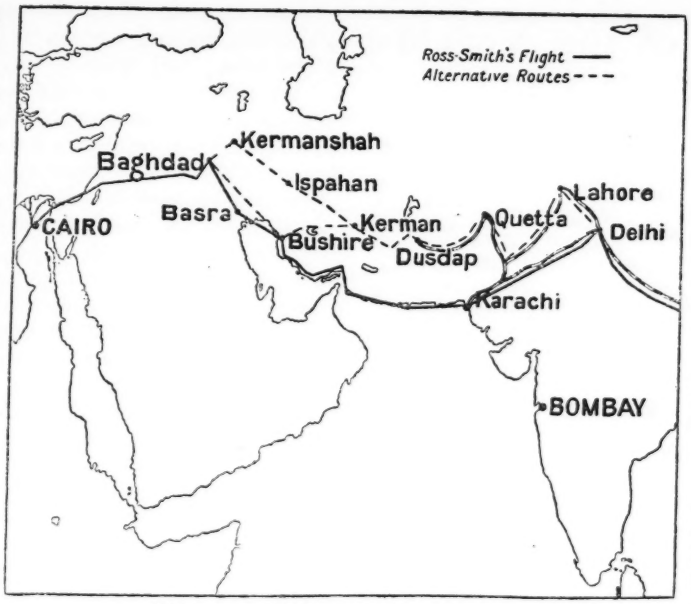
MAP 4.—AIR ROUTES OF THE WORLD.

one may proceed northward to Delhi, and so to Calcutta, through Cawnpore and Allahabad as Ross-Smith did, or via Ahmadabad and Bombay across country to Calcutta through Nagpur. These routes, and also the route from Calcutta to Port Darwin in the North of Australia, are shown in the fourth map.

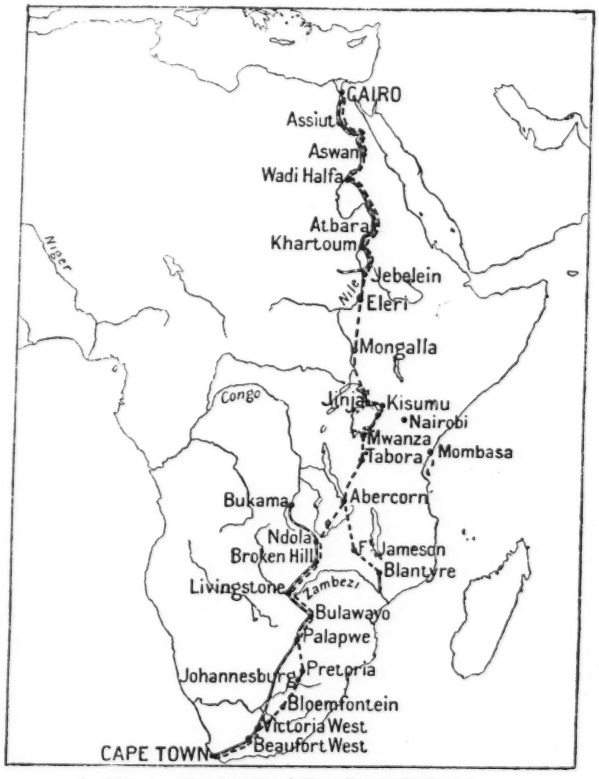
From Calcutta the route to Australia, as flown by Ross-Smith, is via Rangoon and Bangkok to Singapore, thence to Kalidjati in Java, and via Bima to Atambœa in Dutch Timor. The final stage across the sea to Port Darwin is a distance of 460 miles.

* * *

Of all the aerial routes, the one which probably appeals most to the imagination is that between Cairo and the Cape. This has been recently flown. Along this route, a distance of between five and six thousand miles, there exists a chain of forty-three aerodromes. The route can be best followed by reference to the third map. From Cairo to Eleri in the main the course of the Nile is followed. From Jinga to Mwanza, Lake Victoria is skirted on the eastern shore. A difficult piece of country is encountered between Mwanza and N'dola. From N'dola to Palapwe the route follows roughly the railway, and thence via Pretoria and Bloemfontein it ends at Cape Town.



MAP 2.—AIR ROUTE, CAIRO TO KARACHI.



MAP 3.—AIR ROUTE, CAIRO TO CAPE TOWN.

* * *

The journey from this country to America is likely to be the most difficult of all to accomplish regularly by air. As is well known, the Atlantic has been crossed in a flying-boat via the Azores by Commander Read of the U.S. Navy, by direct flight in an aeroplane by the late Sir John Alcock, and out and back by Major Scott in an airship.

From St. John's, Newfoundland, to Clifden in Ireland is a distance of 1,930 miles, and to Lisbon via the Azores is nearly 2,400 miles, so that getting over is a "tough proposition."

In the fourth map the air routes of the world are shown. The oversea distances are given in miles. The letters are the initial letters of the names of towns, and should suggest the names without difficulty. C.V. stands for Cape Verde Island.

The map embodies, in addition to the routes described, routes which have been suggested for crossing Canada, crossing Australia to New Zealand, and for getting to China and Japan.

The Origin of the Vegetation of the Land

By A. C. Seward, F.R.S.

Master of Downing College and Professor of Botany, Cambridge

EVEN though we shall never solve many of the problems connected with the early history of the earth, there will always be a fascination in getting the most out of such facts as are available, and drawing upon our imagination for the rest. The origin of life is one of the oldest and most attractive problems that will long continue to exercise speculative minds. A recent contribution to this subject has recently been made by Dr. Church,[1] of Oxford, which deserves careful attention; but it is not with this that we are now primarily concerned. The same author has dealt in a masterly manner with the origin of the vegetation of the land.[2] The hypothesis he elaborates is not only ingenious, but the arguments are logically presented, though in a style which, it must be confessed, is not easy reading even for the specialist. The problem, briefly, is this: What was the origin of the vegetation of the land as distinct from that of the water?

The majority of plants live on land: trees, shrubs, herbaceous flowering plants, Ferns, and Mosses, are either wholly or with comparatively few exceptions dwellers on land. They draw their supply of carbon from carbon dioxide, a gas which forms one of the constituents of the atmosphere; the atmosphere contains about three parts of carbon dioxide in 10,000. The structure of the bodies of the more highly organised plants is intimately connected with the needs of a life on land. The roots take up raw material in solution from the soil; they act as absorbing organs as well as holdfasts; the stem and branches bear the leaves and flowers, or other reproductive organs; some of their tissues are concerned with the conduction of water and with the transport of the organic compounds manufactured in the green leaves to those organs where building-material for new cells is needed. A land plant absorbs water only from the ground, and it must, therefore, be provided with an efficient system of channels for conducting water to all parts of the plant-body. In the higher plants the method of reproduction also is in harmony with land conditions. Thus, some of the essential features of a typical land-plant—for example, a Pine-tree or an Oak—are: (i) that it draws from the soil and the air all the raw material from which it builds up its substance; (ii) that it is able, by means of certain specially strong tissues, to maintain an erect position and to resist the force of the wind; (iii) that it can reproduce its kind without the aid of any reproductive cells endowed with the power of locomotion. A water-plant, on the other hand, is supported by the medium in which it lives. In a seaweed, moreover, which is entirely surrounded by water, absorption is not localised in a special organ, but an efficient water-supply is assured by the permeability of the whole plant, and no special conducting tissue is needed.

In the Ferns, Mosses, and Algæ[3] the act of fertilisation is accomplished, with rare exceptions, by means of free-swimming or floating male cells, and motile or non-motile female cells (eggs). This character is a legacy from ancestors which passed their lives in water, but the higher plants have lost this relic of an aquatic ancestry. Ferns and Mosses, for example (in contrast to aquatic Algæ, which are fully equipped for life in water), may be described as amphibious; though they live for the most part on land and produce spores dispersed by the wind, they are still dependent for fertilisation upon water, as their male reproductive cells swim to the female cells.

We know, from a study of the rocks, that the present vegetation of the land represents merely a stage in a succession of plant-associations which have colonised the earth during millions of years; and we are also in a position to assert that no satisfactory evidence has so far been discovered of the existence of a land-vegetation before a certain period in the history of the earth.

At what stage, then, of geological history did plants first establish themselves on the land? The oldest-known rocks are spoken of by geologists as Archæan: these rocks form a considerable part of the North-West Highlands of Scotland and occur in North and South Wales, in the Malvern Hills, and elsewhere. They consist of granites and other coarsely crystalline rocks of igneous[4] origin, covered in some regions by a great thickness of grit and sandstones formed by the action of denuding agents, rain and frost, and either deposited as sheets of pebble-beds, grit, and sand on the surface of the land, or accumulated as sediments under water. The Archæan rocks reach an enormous thickness, and afford unmistakable evidence that their formation occupied a length of time in the early history of the world which is beyond our comprehension. They give very little information about the kind of life that existed when they were being formed, and there is at

[1] *The Building of an Autotrophic Flagellate.* Oxford University Press, 1919.

[2] *Thalassiophyta and the Subaerial Transmigration.* Oxford University Press, 1919.

[3] A large class of plants, most of which live in water; it includes seaweeds, also many simpler types of plants living in fresh-water and on damp surfaces.

[4] Formed by volcanic agency, or from molten material crystallised under great pressure and at a considerable depth below the surface.

least no direct evidence that Archæan lands were tenanted by plants. Resting upon Archæan rocks, and occupying the next place in the succession of geological formations, are thousands of feet of what are called the Cambrian strata, for the most part consisting of material derived from the wear and tear of rocks exposed to the air, which was eventually spread out on the floors of oceans. These Cambrian rocks, with the fossils they contain, tell us much of the animals which lived in the sea, and furnish some evidence of the occurrence of seaweeds. Of a land vegetation they tell us nothing. The next two periods are known as the Ordovician and Silurian. These two chapters of ancient earth-history are represented by vast thicknesses of marine sedimentary strata, and, particularly the Ordovician period, by a considerable development of volcanic lavas and ashes of submarine origin. Much of the most picturesque scenery of the English Lake District is due to mountains composed of volcanic and sedimentary rocks of Ordovician age, originally formed under the sea and then upraised as mountain-chains which, through long exposure to denudation, have lost much of their former grandeur. Both the Ordovician and Silurian rocks, though rich in marine fossils, have hitherto furnished no thoroughly satisfactory records of land-plants.

Passing to the Devonian period, the next stage of geological history, we find that in some parts of the world marine strata were built up on the floor of the open sea as in the preceding periods, while in other regions material worn by water and frost from the surface of the land was being piled up on the floors of large freshwater lakes and arms of the sea. Rocks of the latter type, usually spoken of as Old Red Sandstone, are a characteristic feature of much of the country encircling the Highlands of Scotland; they occur also in the Shetland Isles, Scandinavia, Ireland, and other parts of the world. It is in Devonian or Old Red Sandstone strata, deposited in lakes or enclosed seas, that representatives of the oldest known land-vegetation have been discovered.

By far the most important samples of this ancient vegetation of the land are the petrified plants, beautifully preserved, with their most delicate cells intact, which were discovered a few years ago by Dr. Mackie, of Elgin, in certain siliceous Devonian beds in Aberdeenshire. Detailed descriptions of some of these fossils have been published in the *Transactions of the Royal Society of Edinburgh*, by Dr. Kidston and Professor Lang (1917, 1920). Many other Devonian plants have been described from different parts of Scotland, from Ireland, Devonshire, Canada, the United States, Norway, Bohemia, Germany, and elsewhere.

It is by no means improbable that plants existed on the land during at least part of the inconceivably long period of earth-history which had passed before the Devonian period began. All that can be said is that the records of pre-Devonian rocks tell us practically nothing of any land-vegetation there may have been. The question now before us is, where were the first land-plants evolved? Were they evolved from simpler forms which originated on an exposed land-surface, or were the earliest land-plants descendants of Algæ living in the sea? Some writers favour the view that plant-life began in freshwater pools on a primeval continent, and it is often assumed that some existing freshwater members of the Algæ, if not themselves the ancestors of the more complex inhabitants of the dry land, at least indicate the lines followed by evolution. Another view is that plant-life began in the sea; Algæ inhabiting the shallow coastal regions migrated, it is thought, through rivers to inland waters and eventually established themselves on the land, thus forming the starting-point of the complex terrestrial plants. Dr. Church suggests a different course of evolution: "The beginnings of Botany are in the sea"; he believes that before continents and oceans divided the world between them, the earth's surface was covered by water; a world-ocean two miles deep wrapped completely round the solid crust. This is, of course, an assumption; and though it is directly opposed to the opinions usually expressed by geologists, the possibility of a complete covering of water is not, so I am informed, beyond the range of possibility from an astronomical point of view. In this original ocean life was evolved—the method of evolution does not now concern us; during a long period the earliest organisms increased in complexity, and at length single-celled plants were produced capable of manufacturing their own food, like the small aquatic green plants of to-day, that build up their substance from salts and carbon dioxide gas absorbed from a watery medium. Thus, the world-ocean, not as yet penetrated by any part of the earth's crust, became tenanted by hosts of unicellular and free-swimming plants. At a later stage, in response to those forces which have been constantly acting on the mass of the earth, portions of the crust rose to within 150 to 100 fathoms of the surface of the ocean and came under the influence of the sun's rays. On this feebly illuminated floor of the shallow sea some of the free-floating plants adopted a sedentary habit, and by slow degrees from unicellular forms were evolved multicellular and more complex seaweeds, which were anchored to the rocks by root-like holdfasts. As time elapsed, these anchored forms developed into larger seaweeds, surpassing, it is believed, both in their structural complexity and in their reproductive mechanisms, even the highest types of existing brown, red, or green marine Algæ. The

third stage was inaugurated when domes or ridges of the solid crust of the earth emerged as islands or embryo-continents above the primeval ocean. Anchored submarine plants found themselves transferred from water to air: for a time they would be washed at intervals by the waves, but as elevation continued they became more and more restricted to an environment of air containing an abundant supply of aqueous vapour. This change naturally imposed serious problems upon organisms adapted to a purely watery habitat. The better-equipped types, Dr. Church suggests, successfully coped with the new conditions; their anchoring holdfasts acquired the function of absorbing organs; and the water with mineral salts in solution, which they imbibed, had to be conveyed by newly developed conducting tissues to all parts of the plant-body, which was now no longer bathed by water. Adjustment was necessitated in the mechanism for propagation; reproductive cells capable of dispersal in the air were substituted for cells adapted for locomotion or transport in water. Thus was effected a transformation of complex seaweeds into land-plants, and it was this direct passage from sea to air that gave birth to the future vegetation of continents and islands. If this hypothesis is correct, it means, as its author points out, that all the groups of land-plants trace their ancestry to a stage in the history of the world when a world-ocean was inhabited by swarms of free-floating, single-celled representatives of the plant kingdom.

Dr. Church is of opinion that the uplift of portions of the earth's crust, with their attached seaweeds, occurred in the Archæan era, in the earliest stage of geological history. If this was so, it is surprising that no fossil remains of this first land vegetation have been found; and it may well be that the first stage in the evolution of a land-vegetation—assuming the general correctness of the hypothesis that has been outlined—occurred at a later period in the history of the earth. It is a well-established fact that in some parts of the world, mostly in the north-west European area, there was a great uplift of the earth's crust in the Silurian, and during the earlier phase of the Devonian periods. This widespread folding of the crust produced vast mountain systems, called by the late Professor Suess the Caledonides, and the worn-down roots of some of these ranges form the present mountains of the north-west Highlands of Scotland. As we have seen, it is in the Devonian rocks that the earliest undoubted land floras have been discovered. Whether or not the successful transference of seaweeds to life on the land occurred in the Archæan or in a subsequent period, the interest of Dr. Church's attractive and ably worked-out hypothesis lies in the possibility of the adaptation of organs, which had been evolved in the sea, to the very different conditions of life on land. The views he expresses, though open to criticism on geological and biological grounds, are worthy of close examination; they are concerned with a problem that is perhaps insoluble, but they are at least suggestive, and in many respects more convincing than any previously put forward.

St. Francis of Assisi (A.D. 1182-1226)

By A. G. Little, M.A.

"WHY after thee?" asked one of his companions of St. Francis. "Why doth all the world follow after thee, and why doth every man desire to see thee and to hear thee and to obey thee? Thou art not fair to look upon; thou art not a man of great parts; thou art not of noble birth. Whence cometh it, then, that all the world followeth after thee?" St. Francis's "lowly answer" that God had chosen him to confound the might and wisdom of the world, "because He hath found no viler creature on earth," can hardly have seemed a complete explanation to Brother Masseo, nor can it satisfy us. The interest shown in St. Francis is different, not only in degree but in kind, from the interest taken in any other mediæval saint; it is not only erudite or devotional, though it is both of these; but men of very different faiths have studied, and are studying, the life of St. Francis with the conviction that it contains some practical message for all time and for to-day.

The hold which St. Francis always had on the affection of the world is no doubt partly due to the large amount and to the nature of the literary material concerning him which has survived from early times. No saint is so well known. The charming and poetical stories known as the *Fioretti*, or *Little Flowers of St. Francis*, have rejoiced generation after generation ever since they were collected together and translated into Italian early in the fourteenth century. There are excellent English translations of the *Fioretti*, such as that by Professor Arnold and that by Professor Okey; but they are easy to read in the original, and form an attractive introduction to the study of Italian. The collection does not include, by any means, all the stories which were current at the time when it was made, and several which might well have been included have recently come to light. One of these tells how Francis and his first follower, Bernardo, being tired and hungry, went

to beg for food, agreeing to meet at a certain stone. Francis came back with his scraps, but Bernardo confessed with shame that he was so hungry that he had eaten all the crusts given to him. Francis shed tears of joy (or laughed till he cried), and said: "Thou art more blessed than I, dear son; thou art truly a perfect observer of the Gospel; for thou hast gathered nothing and kept nothing for the morrow, but hast cast thy whole thought upon the Lord."

The number of books on St. Francis which have come out in the last thirty or forty years is enormous, and is still growing. It is something more than a literary fashion. It is noteworthy that the first impetus to Franciscan studies proceeded, not from Catholic but from Protestant circles, and a certain amount of religious controversy has been mixed up with the history. It is easy to see what attracted Protestant theologians and historians to St. Francis: it was his attempt to go back directly to the Gospels for inspiration, and to reproduce again on earth the life of Christ and His Apostles. He habitually claimed immediate revelation from God as his authority. "After the Lord had given me the care of brethren, no one showed me what I should do, but the Most High revealed to me that I should live according to the pattern of the Holy Gospel." One can hear in this sentence from the Testament of St. Francis an echo of the perennial conflict between prophet and priest; but some of his recent biographers have over-emphasised the differences between the saint and the Papacy, and have even suggested that he was not a loyal and submissive son of the Roman Church. The charge has been brought against Paul Sabatier—not without a certain measure of justification—that his famous *Vie de Saint François* represents the poor man of Assisi as a precursor of the Reformation. Sabatier's profound researches into Franciscan history since he wrote the *Life* have materially modified his original views, and we may look for considerable changes in the revised *Vie de Saint François* which he has prepared; but his original views were far nearer the truth than those which make St. Francis a passive instrument in the hands of the Roman hierarchy.

Few have reconciled more completely than St. Francis submission with liberty. His attitude to the Church may be compared with that of a loyal subject to the State. The loyal subject recognises the authority of the State; but that does not prevent him from endeavouring to change and reform the State, and bring its policy into harmony with his own ideas. A point may come when one has to choose between rebellion and submission either to Church or State; this point was reached by some of St. Francis's followers a century later, when they renounced allegiance to the "carnal Church" and tried to establish a spiritual Church. It is safe to say that the idea of rebellion never even occurred to St. Francis. He was saved from this partly by the wisdom of the rulers of the Church, but mainly by his own character and power.

Pope Innocent III was an autocrat, but he did not claim a monopoly of initiative, and was willing to admit that a simple layman might have surer instincts, might be more truly inspired by God, than a Pope. Francis asked his approval for the way of life which he had already chosen for himself and his followers. "Pray God, my son," the Pope replied, according to one account, "that He reveal unto thee whether what ye seek cometh of His Will, so that we, being assured of the Lord's Will, may accede unto thy desire." "Go," he said finally, "and the Lord be with you, brethren, and as He shall deign to inspire you, preach repentance to all."

There is plenty of evidence of the extraordinary power exercised by Francis over all classes of people. He radiated peace, goodwill, and confidence. It was not what he said, but his personality, that affected them. A learned philosopher remarked that, while he could remember every word of the sermons of others, "the words uttered by holy Francis alone escape me; and if I commit any of them to memory, they do not seem to me the same that dropped from his lips before." Another description of his preaching—by the Archdeacon of Spalato—runs as follows: "In 1222, on the day of the Assumption (August 15), when I was a student at Bologna, I saw St. Francis preaching in the piazza in front of the public palazzo. Almost all the city had assembled there. His text was 'Angels, men, devils,' and he discoursed of these three rational spirits so well and wisely that many learned men who were present were not a little amazed at the words of such an ignorant man. Yet his style was not that of a preacher, but of a man conversing. The whole matter of his discourse was an appeal to extinguish enmities and to make lasting peace. His dress was mean, his appearance contemptible, and his face without beauty; but God lent such power to his words that many bands of nobles, among whom the savage fury of ancient feuds had raged with much shedding of blood, were brought back to the way of peace. Such was the reverence and devotion which he inspired that men and women rushed to him in crowds, happy if they could touch the hem of his garment or carry off some bit of his habit."

A peacemaker had no lack of opportunity in thirteenth-century Italy. Feuds between families, between cities, between classes, between parties, between ecclesiastical and civil authorities, were everywhere prevalent, and every success involved reprisals and every act of violence intensified hatred. When Francis lay dying, a great quarrel arose between the

Bishop and the chief magistrate of Assisi: the Bishop excommunicated the magistrate and the magistrate boycotted the Bishop. Francis, hearing of it, added another verse to his "Praises of the Creatures" or "Song of Brother Sun": "Praised be Thou, O my Lord, of them that forgive for love of Thee," and told his companions to get the two enemies together and sing it to them; whereupon Bishop and magistrate both confessed themselves in the wrong, asked forgiveness, and fell into each other's arms. Francis made no attempt to go into the merits of the case; he simply substituted an atmosphere of love and mutual trust for one of hatred and suspicion. He attached much importance to the power of music and singing, and wished that his brethren after preaching should sing the praises of the Lord, and that when the song was ended the preachers should say to the people: "We are the minstrels of the Lord, and the pay that we ask of you is that you should be in a state of true repentance." For he would say: "What are the servants of the Lord but His minstrels, who lift up the hearts of men and move them to spiritual gladness?"

If we ask what was the secret of his power, there is no adequate answer; but it may be found partly in three qualities which he possessed in a pre-eminent degree—sincerity, sympathy, and selflessness.

If he was ever actuated by "mixed motives," he at once made public confession, "that he might not appear outwardly other than he was inwardly." "Once, when he was walking through Assisi, he met an old woman who asked him to give her something. Having nothing but a cloak, with ready bounty he gave her that. But perceiving an impulse of self-complacency stealing over him, he immediately confessed before all the bystanders that he had been moved by vainglory."

Many instances are recorded of his power of divining the unspoken thoughts and feelings of others, which to his biographers appeared miraculous. "Saintlier than saints," says his earliest biographer, "among sinners he was as one of themselves." He never felt himself superior to anybody, and one product of his humility and sympathy was a natural courtesy to all sorts and conditions. "Courtesy," he said, "is an attribute of God Himself, who makes His sun to shine and His rain to fall equally upon the just and upon the unjust: and courtesy is the sister of charity, and quenches hates and keeps love alive."

His sympathy extended to all nature. He regarded the sun and fire as brothers, the birds and flowers as sisters:

> Communing in this sort through earth and heaven
> With every form of creature, as it looked
> Towards the Uncreated with a countenance
> Of adoration, with an eye of love.

Francis craved nothing for himself and his followers except the right to possess nothing—the "privilege of poverty." The friars differed from the monks in this among other things, that their vow of poverty involved the renunciation not only of private but also of corporate property. But renunciation of property is a poor way of expressing St. Francis's enthusiastic devotion to Holy Poverty—"that celestial virtue by which all impediments are lifted away from the soul, so that she can freely unite herself to the eternal God." We are accustomed to think of a poor man as one who lacks the advantages of riches: St. Francis thought of a rich man as one who lacked the inestimable boon of poverty. He served the "Lady Poverty" as a knight in the romances of chivalry served his ideal lady. Such service must be free. Francis had no desire to deprive other people of their property; he set an example, which others might follow, but the sacrifice must be willing.

His attitude is hard for us to understand; it was also hard for his contemporaries, and in defending his ideas to the magnates of the Church he used less exalted and more comprehensible arguments. "If we should have possessions, we should need arms to protect ourselves. For thence arise disputes and lawsuits, and for this cause the love of God and our neighbour is wont often to be hindered, wherefore we are minded to possess naught of worldly goods in this world."

The early friars lived by the labour of their hands and by alms. "I worked with my hands," said St. Francis in his last Testament, "and I wish to work, and I wish firmly that all the other brothers should work at some labour which is compatible with honesty. . . . And when the price of labour is not given to us, let us have recourse to the table of the Lord, begging alms from door to door." In course of time, as the friars' work became more and more that of preachers and teachers, manual labour was confined to the work of house and garden (there is a story that, when the Pope's envoys brought the Cardinal's hat to Bonaventura, he was washing up the dishes, and asked them to hang it up outside), and the friaries depended, like many churches, schools, and hospitals to-day, on voluntary contributions.

The rapid increase and spread of the Order necessitated a more elaborate organisation and rules for the enforcement of discipline. The reign of love had to yield to the coarser reign of law. Francis was not an organiser, and was more alive to the evils than to the advantages of organisation. The exercise of authority by one man over others was repugnant to his nature. Those in authority should be ministers and servants; and erring friars, when they go to them, "may speak and act with them as masters with their

servants." That is in the Rule. A topsy-turvy world, but it must be remembered that Francis aimed at putting into practice the precepts of the Gospel. The task of reconciling the ideal with the real was beyond him. He had always taught his followers that they must convert by humility and reverence, and so now, when they demanded other methods, he "would not become an executioner to punish and

BROTHER LEO KNEELING BEFORE ST. FRANCIS.
From the *Little Flowers of St. Francis* (T. W. Arnold), by kind permission of Messrs. Chatto and Windus.

scourge them, like the magistrates of this world," but retired more and more from the management of affairs; he tried to fulfil his ideal in his own life, and be an example, or "Mirror of Perfection," to the brethren, "and at the end his spirit did herein find rest and comfort."

One among the many services rendered to Franciscan history by Sabatier is his rediscovery and rehabilitation of the *Speculum Perfectionis*, or "Mirror of Perfection,"[1] but few will now admit his contention that the original version of it was written by Leo, the secretary of St. Francis, in 1227, and was consequently the earliest *Life* of the saint. The view which is now held by most Franciscan scholars is that the *Mirror of Perfection* dates in its present form from about 1318, but that it contains, in a more or less revised shape, many chapters and narratives written by Brother Leo, and perhaps by other companions of St. Francis. The aim is to distinguish between genuine and spurious, or garbled, versions of the narratives, and if possible to recover the originals.

St. Francis died on October 3, 1226, and the earliest *Life* of him is that written by Thomas of Celano[2] in 1228–9. Celano was selected for the office of biographer because he was a stylist; his work has many merits, but suffers from two defects: the writer had very little personal acquaintance with Francis; and he knew too much about the lives and legends of other saints. There is thus a certain tendency—conscious or unconscious—to assimilate Francis to the traditional and conventional saint.

When, in 1244, it was decided to revise and supplement the first *Life*, the task was again given to Celano, but with him were associated the friars who had been the companions of St. Francis in his last years (especially Brother Leo), and they supplied most of the new matter which Celano worked up into literary form in the second *Life*. Some of the contributions made by the companions are incorporated in the *Speculum Perfectionis*, and a few more have recently been found.

One example may be given. Celano, in the second *Life*, tells how Francis one night in his last illness longed for a little parsley, and of the difficulty he had in persuading the Brother Cook to go out and hunt for it on a dark, windy night. When at length the parsley was found, Francis improved the occasion by saying: "My brethren, obey orders at once, and do not wait for them to be repeated; and do not allege that anything is impossible, for even were I to bid you to do anything beyond your strength, obedience would not be wanting in strength." That is what a saint ought to have said. A primitive version—probably a copy of the original supplied by Leo—of the narrative was discovered in a manuscript a few years ago. The story of the parsley is given in simpler language than Celano's and far more vividly, and St. Francis's words are: "My brethren, you should not make me say a thing so often" (*Fratres mei, non*

[1] *Speculum Perfectionis seu S. Francisci Assisiensis Legenda Antiquissima.* Ed. P. Sabatier, Paris, 1898. Translated by Evans (Nutt), Okey (Dent), etc.

[2] Both the *Lives* by Thomas de Celano were edited by E. d'Alençon, Rome, 1906: translation by Ferrers Howell, Methuen, 1908.

debetis me facere dicere rem totiens)—not what a saint ought to say, but the weary protest of a sick man.

Other examples are contained in the same manuscript,[1] and more discoveries of the same kind must be awaiting the careful and lucky researcher. Each point by itself is small: the cumulative effect is considerable, and the more we can recover of the actual written words of those who knew St. Francis best, the more vivid, the more human, and the more true, our conception of him will become.

NOTE.—References to the literature on the subject will be found in the writer's *Guide to Franciscan Studies*, S.P.C.K., 1920.

Flying—and Its Outlook from a Postal Telegraph Point of View

By A. S. Baxendale, M.I.E.E.

MUCH has been said and written about Commercial Aviation, but except for valuable contributions from Mr. Holt Thomas, particularly regarding costs ascertained by more or less bitter experience, I have heard or read little on this subject that has not conveyed to my mind the impression that the speakers and writers have only vague notions as to the possible directions in which aviation can render real benefit to the public.

The importance of concentration along lines of least resistance, combined with a just value of the objectives in view, will be recognised by those who have seen how disastrously some inventions and enterprises of immense potentialities have been retarded in their development because their progenitors have from their angle of view seen only some small side-track instead of the main-line along which progress should have been made. In other cases it would seem that the protagonists have fallen in with the view of those of their financial friends who consider that the best use to which anything can be put is to convert it into a gambling counter.

Perhaps the views of one who has spent more than twenty years in organising and controlling postal and telegraph services will serve to give a practical turn to the consideration of some of the more important points involved in the development of air transport.

In aerial as in all other forms of transport the first consideration is that of reliability, and, unlike other forms of transport, reliability in the air depends largely on speed. At a safe cruising height—an altitude, say, of 4,000 to 5,000 feet—a gale of 80 knots often prevails, and a comparatively slow machine facing this gale is more or less in the same predicament as a slow steamer endeavouring to go upstream in a river having a current of, say, 15 knots.

Next to regularity, the most important consideration is frequency of service, and if it were not for the fact that regularity depends on speed,[2] speed would be much less important than frequency of service.

With equal reliability two services a day at an average of 70 miles an hour would be much more useful than one of upwards of 100 miles an hour.

The service now being operated between London and Paris, which, though scheduled and under contract with the Post Office to ply daily, must still be considered in the light of an experiment, affords a good example of the futility of operating a single dispatch service.

It will be seen from the following table that, for nearly every hour of the day when letters are generally posted, the length of time elapsing between the posting and delivery of correspondence (called technically "the delay") is considerably greater in the case of air transport than by the ordinary postal services by means of rail and steamship.

Letters posted in London at	Should be delivered in Paris by air	Should be delivered in Paris by post
10 a.m.	6 hours later[3]	22 hours later[4]
11 a.m.	5 ,, ,,	21 ,, ,,
Noon	28 ,, ,,	20 ,, ,,
1 p.m.	27 ,, ,,	19 ,, ,,
2 p.m.	26 ,, ,,	18 ,, ,,
3 p.m.	25 ,, ,,	17 ,, ,,
4 p.m.	24 ,, ,,	16 ,, ,,
5 p.m.	23 ,, ,,	15 ,, ,,
6 p.m.	22 ,, ,,	14 ,, ,,
7 p.m.	21 ,, ,,	13 ,, ,,
8 p.m.	20 ,, ,,	36 ,, ,,

By an air service of 70 miles an hour—assuming such to be maintainable—with two machines starting daily each way respectively at 7 a.m. and 4 p.m., the average delay would be reduced to 13 hours 19 minutes, as against an average of 22 hours 31 minutes by the fast machine performing only one service a day, and an average by the ordinary postal service of 19 hours 12 minutes. A further increase in the fre-

[1] Described in *Collectanea Franciscana I* (British Society of Franciscan Studies, vol. v).

[2] Speed has its disadvantages from the point of view of requiring greater space for landing and rising. The fast machine that will land like the proverbial poached egg has not yet been built, and many of the fast types land at a speed of fifty to sixty miles an hour. In spite of this fact, however, it must be taken that for regularity of service high speed is essential.

[3] Leave Hounslow 12.30, delivered Paris 4 p.m.

[4] Leave London by night mail, delivered in Paris 8 a.m.

quency of service from one to, say, twelve dispatches a day would render the air mail not only in all cases much more rapid than the ordinary postal service, but generally speaking more rapid than telegraphy, even should the normal telegraph service be more or less restored.

The question now arises as to the cost and difficulty of greatly increasing the frequency of air services. It is in this respect that the true fundamental advantage of air transport for the rapid delivery of passengers and correspondence at their destination is most easily demonstrable.

The load required to make a trip between London and Paris reasonably remunerative, assuming the service is frequent and the cost of the machines in use does not exceed on the average £1,000, is one passenger, 100 letters, and 150 lb. of goods at the prices now charged. If it were found difficult to secure even this small load at present prices, the rates could be lowered to some such figure as £5 for passengers, 3*d*. for letters, 1*s*. for aerograms of any length (in addition, of course, to local telegram rates), and 1*s*. a lb. for goods. An average load of two passengers, 500 letters, 100 telegrams, and 200 lb. of goods would then be sufficient to render the service self-supporting.

Having been closely concerned in fixing the aerial letter-rate between Paris and London at the charge of 2*s*. 6*d*., I feel it necessary here to explain how this tariff, which I consider much too high in the present circumstances, came to be chosen.

At a formal interview I had with M. Clementel (Minister of Commerce) and M. Pasquet (then head of the permanent staff of the Postal Telegraph Department) regarding the establishment of an aerial mail service between France and England in 1917—when the ordinary postal service was occasionally discontinued for days together—I was asked what rate I would propose should be charged. I pointed out that the rate would have to be one that would limit the use of the service to senders of letters of real importance, for not only had we but little spare carrying capacity in the machines which it was proposed to employ, but in view of the strict censoring that took place at that time, we wished to reduce the mail to such proportions as would enable the censors at the aerodrome to deal without excessive delay with the whole mail; and I suggested three francs as a charge that would restrict the public use of this service to such an extent as to keep the air mail within the required limits. MM. Clementel and Pasquet accepted this figure. When the present service was commenced and it was desired that it should be utilised by as wide a public as possible, I was naturally surprised to see the charge fixed at a figure which I had suggested would be generally considered prohibitive.

I am inclined to think that double the registered express postage rate would be about as high a rate as should be charged.

As regards the load of telegrams that I anticipate will be carried, I will take this opportunity of recording my considered opinion that the first of the great public services to feel the competition of aerial transport will be cable companies.

In order to realise the limitations of telegraphy, it is necessary to appreciate the folly of a remark attributed to one whose leading characteristic is not generally believed to be lack of intelligence. The remark was to the effect that "aerial transport will never compete with wireless telegraphy until the plane travels at the same speed as the wireless wave," viz. 180,000 miles a second. The rate of travel of electricity is about as closely related to the speed of telegraphy as the speed at which sound travels is to the performance of any given stenographer. It may interest the layman to know that, had all the trans-Atlantic cables been interrupted for a week prior to Sir John Alcock's flight, and had he carried one half of the accumulated cable traffic, while the other half had to be dealt with by wireless, Sir John Alcock's half would have been delivered as expeditiously as it is now ordinarily carried by cable, whereas the wireless half would have been "cleared" at about the time of the death of the great pilot.

In these days, when labour-saving has become a matter of paramount importance, it seems to me impossible to doubt that the greater number of international messages which would now be dealt with solely as telegrams will in the not very distant future be dealt with in the countries of origin and destination telegraphically or telephonically, while they will become aerograms so far as international transport is concerned.

It must be remembered that any ordinary commercial aeroplane can convey as many telegrams as thousands of operators can handle—and there are many international aerial services which might be established even to-day where the delay on aerograms would be anything from one-half to one-twentieth of that now occurring on telegrams.

When, if ever, what we consider normal telegraph services are in operation, they will generally afford a quicker means of communication than will aerial transport, but it has now been amply demonstrated that those who held the view that the majority of cablers require speed without regard to cost were entirely mistaken.

It was more than twenty years ago that I established the "deferred" telegram system (at half the "ordinary" rates) in the Federated Malay States. I was not, therefore, misled by the arguments of theorists when,

as Manager of the Pacific Cable Board (which led the way in the world-wide adoption of deferred cable rates), I was informed by most of my old cable friends that we were catering for a public that did not exist.

As a matter of fact, I believe I am correct in saying that in 1913, 75 per cent. of all cable traffic was sent at deferred rates. What I consider to be really a striking fact is that in the first half of 1914 the latter development of the "week-end cable letters" (at quarter rates) was fast becoming so popular that they already amounted to quite a considerable proportion of all the traffic. In view of these facts, no doubt can exist in the mind of any reasonable person that there is a very large public ready at any time to take advantage of any means of communication which is considerably more rapid than the Postal Service, and willing to pay for such communications at rates calculated on a word basis.

Whether the operation of such services will be remunerative depends on their treatment by the Government. So far the authorities have failed to give even the assistance they might have given without cost to the public funds. The grant of machines without charge to companies performing public services would have enabled the contractors to fix rates independent of depreciation, and these rates would have been substantially lower than those which are possible when depreciation (still an unknown quantity in commercial aviation) has to be provided for.

Having sold the spare machines in their possession —to a private company at a nominal price—it would seem that, if the Government proposed to give assistance to the commercial air services, this assistance must now take the form of a subsidy, or the equivalent of a subsidy, such as guaranteed remunerative loads. Unless some form of State aid is given, the United Kingdom is likely to lag behind in air transport. If my view is correct that the essentially British enterprise of submarine cable telegraphy will in the course of some few years be engaged in a life-and-death struggle with aerial transport, this kingdom will indeed be hard hit should this latter means of communication then be under foreign control—and in receipt of heavy subsidies.

Messrs. Longmans hope to have ready early this month *The Life and Work of Sir Jagadis C. Bose*, founder of the Bose Research Institute, Calcutta, by Professor Patrick Geddes, of the Department of Sociology and Civics, Bombay University. The memoir, which includes numerous illustrations, shows Bose, the first Indian of modern times who has done distinguished work in science, not simply as a physicist of fine experimental skill, but also as a naturalist of the keenest interest in life-processes and life-movements.

Correspondence

To the Editor of DISCOVERY

SIR,

Allow me a brief note on Professor Calder's interesting article in the April issue on "The Date of the Nativity." The argument is on the whole impressive, but there is adduced a parallel from Scottish History which, not being a real parallel, rather weakens it.

On p. 102, column 2, about the middle, Professor Calder says: "Quirinius's engineers could no more have constructed this elaborate system of roads—one of them through the very heart of the Homanadensian country—before the complete subjugation of the mountain tribes than General Wade could have built his fortresses and roads in the Scottish Highlands before Culloden."

Unfortunately for the analogy, General Wade constructed his wonderful roads and bridges not after, but *with a view to*, the complete subjugation of the Highlands. In consequence of the disorders which prevailed before and after the Jacobite Rising of 1715, the Government sent Wade in 1724 to report on the situation. When he returned about two years later as Commander-in-Chief of the royal forces, he set about his great task of opening up the Highlands by a road system which would provide communication alike for warlike and for peaceful purposes. He was able to do much in the way of pacifying the clans, but still many Highlanders cherished their loyalty to the exiled dynasty, and the landing of Prince Charlie in 1745 set the heather on fire.

Wade retired from the command on the appointment of the Duke of Cumberland, who defeated the "Rebels" at Culloden on April 16, 1746.

The sequence of things is therefore just the opposite of what Professor Calder represents.

CAMPBELL M. MACLEROY.

13 WESTBOURNE GARDENS,
GLASGOW.
April 22, 1920.

PROFESSOR HEARNSHAW AND NAPOLEON

To the Editor of DISCOVERY

SIR,

I have read with great interest the article of Professor Hearnshaw in DISCOVERY for April 1920, but there are some things to which, as an historian, I cannot give my adhesion. I will confine myself to two expressions only, the "escape" of Napoleon from Elba on p. 106, and "Napoleon in his mad adventure of 1815," on p. 107. The word "escape" implies

that Napoleon was imprisoned at Elba, or at least interned. This is quite contrary to the facts, and was indignantly disclaimed by Castlereagh in Parliament. He said that Napoleon was not in any way to be considered as a prisoner in Elba, as the sovereignty of the island had been conferred upon him, and to look upon him in any other light would be a contravention of the Treaty. The "mad adventure" requires more consideration. I shall endeavour to show that it was impossible for Napoleon to remain in Elba, that his march to Paris was one of the most heroic exploits in History, that its conception and execution was a work of consummate genius, that no more emphatic plebiscite was ever given by a nation to the sovereign of its choice, that England, and indeed Europe, had no right to interfere with the decision of the French people, and to impose upon them a dynasty which they detested.

Napoleon had many reasons for leaving Elba. He had no money. Of the annual revenue of two millions of francs from the Grand Livre of France, promised to him and to his wife in reversion by the Treaty of Fontainebleau, not a sou had been paid. The excuse of Castlereagh, that the pension, being an annual one, did not become due till the year had expired, was treated with contempt by Lord Wellesley, and Lord Grey denounced the "low and pitiful expedient of arguing that the Treaty of Fontainebleau had not been violated because the money stipulated did not become due till the end of the year." Talleyrand was endeavouring to persuade his friends in Vienna that the residence of Napoleon at Elba was a danger to France, and that he should be removed by force or fraud to some other place. St. Helena was mentioned, but was considered to be too healthy. But, worse than this, at the very time when Talleyrand was getting his colleagues to sign the Declaration of March 13, one of the most disgraceful documents in the archives of History, he and Fouché were plotting to assassinate the Emperor in his island, to make the "Aiglon" Emperor, with Marie Louise as Regent, and of course themselves as rulers of France. Wellington, an honourable man, put his name to this document, having only just arrived at Vienna, and having not yet discovered with what a scoundrel he had to deal. The Declaration was very properly denounced in Parliament by the Opposition, which, although small in numbers, was more weighty in intellectual and moral force than the Government, and had as leaders the men who afterwards made the beneficent and peaceful revolution of 1832.

What was this "mad adventure"? Napoleon landed at Golfe Juan on March 1, 1815, with 1,100 men and no horses, and entered the Tuileries as a sovereign at 9 p.m. on March 20, without having fired a shot. The most remarkable incident of his progress took place on March 7 at Laffrey. On the narrow road between the lake and the hills a battalion of infantry was drawn up, commanded by Delessart, a boy of nineteen. He said to an officer of Napoleon's, "I am determined to do my duty, and if you do not immediately withdraw I will have you arrested." "Will you fire?" said the officer. "I will do my duty," replied the boy. Napoleon ordered his soldiers to carry their muskets under their left arms and advanced alone. A captain gave the order, "There he is, fire!" The soldiers were livid, their limbs shook and their hands trembled. Advancing within pistol-shot Napoleon opened his overcoat, and said: "If there is amongst you a man who wishes to kill his Emperor, he can do it; here I am." A great shout rose of "Vive l'Empereur!" the ranks were broken, white cockades strewed the ground, and shakos were raised on the bayonets. The soldiers rushed to the Emperor, surrounded him, cheered him, knelt down before him, stroked his boots, his sword, and the hem of his garment. Delessart broke into tears and tendered his sword to the Emperor, who embraced and comforted him. Surely this is one of the great scenes of History!

The debates in both Houses of the English Parliament should be read by every Englishman at the present time. Burdett argued that the Government had no right to impose a sovereign on an independent nation against its will; whoever heard of a single man invading a nation of thirty millions and becoming sovereign against their will? The nation worked for him, greatly from dislike of the dynasty which he overthrew. England had done enough for the Bourbons; they had cost the country eight hundred millions of money and oceans of blood. Napoleon Bonaparte was Emperor of France by the wish of the French people. In his march of five hundred miles there was not a single individual to lift up his hand against him: how could the feeling of the people be more unequivocally shown? Whitbread, perhaps the noblest character in the House, said that the restoration of Bonaparte to the throne of France was even more miraculous than his original elevation to it. Sheridan denounced the manifesto of March 13, and moved an amendment in favour of peace, which was supported by Lord Althorp and Tierney. This is what the best statesmen in England thought of what Professor Hearnshaw calls a "mad adventure." Most Englishmen, acting on the universally accepted principles of the present day, would consider that we had no right to undertake the Waterloo campaign, and some might come to the conclusion that it would have been better for the world, and possibly for ourselves, if Napoleon had won the Battle of Waterloo.

OSCAR BROWNING.

ROME.

To the Editor of DISCOVERY

SIR,

I feel much honoured that the venerable Mr. Oscar Browning, in his distant home, should have thought it worth while to read my article in DISCOVERY on the "Concert of Europe," and I am delighted that it should have called forth from him so vigorous and interesting a letter, even though he writes in criticism of two of my remarks.

The remarks to which he takes exception are fortunately purely incidental; they do not in the smallest degree concern the main thesis of my article. First, he objects to my speaking of Napoleon's "escape" from Elba, on the ground that it implies imprisonment. Secondly, he protests against my calling the Hundred Days a "mad adventure," on the ground that Napoleon was within his rights in undertaking it, and that the French were justified in supporting him.

The first is a mere question of terminology. It is true that, owing to the insistence of Alexander I, a pretence was made that Napoleon was free in Elba, that he was a sovereign potentate, and that he had simply exchanged one realm for another. But it was a transparent fiction. Napoleon was no more free than Elba was an empire. Dr. Emil Reich is not far wrong when he bluntly calls Napoleon "a prisoner." English and other ships patrolled the seas round the island, and kept constant watch. Napoleon, in order to get away, had to elude these vigilant vessels, and therefore his departure from Elba was, in the strictest sense of the term, an "escape."

As to the "mad adventure" of the Hundred Days: here we are in the doubtful regions of conflicting opinion. Mr. Browning maintains that it was a *legitimate* adventure. It might very well have been legitimate and yet at the same time mad, because doomed to certain failure. It would be a sufficient defence of my phrase to show that, even apart from the antagonism of Europe, Napoleon had not a chance of permanent success. The "Liberal Empire" which he proclaimed on his landing in France was no more possible in 1815 than it was when his nephew proclaimed it half a century later. Mr. Browning, however, does not discuss the problem from the point of view of possibility or prudence. He treats it as a question of legitimacy or right. That is an entirely different matter, and one with which I did not profess to deal, either directly or indirectly, in my article. If, however, I were called upon to discuss it, I should be prepared to contend: (1) That the supporters of Napoleon, who had been imposing upon half the peoples of Europe "dynasties which they detested" during the whole of the preceding decade, had little cause for complaint if they were called upon to endure the fate which they had freely inflicted; (2) that the Concert of Europe, or the League of Nations, may be occasionally compelled to do things which offend the sensibilities of individual nations, and that on this occasion the peril of leaving Napoleon at the head of great armies in France was one which, in the interests of Europe, it was impossible to allow.

F. J. C. HEARNSHAW.

KING'S COLLEGE,
LONDON.
May 1, 1920.

The Discoveries in Crete

By George Glasgow, B.A.

[IT is impossible to allow these pages to go to press without indicating, no matter how inadequately, the part played by Ronald Montagu Burrows, who died on May 14, in the establishment of the facts which are here recorded. Since 1900 the avalanche of new discoveries in Crete had been so overwhelming, so revolutionary to all former conceptions of Greek and European history, that scholars and general public alike were left wondering and at sea. In 1907 Burrows published his *Discoveries in Crete* (Murray), and by his complete mastery of the enormous material available, his lucid exposition of it, his brilliant interpretation, which in many cases involved fundamental contributions to knowledge, he provided what was indispensably needed. A second edition was called for in a few months. The book stands as the classic authority on the subject, and links its author's name with that of Sir Arthur Evans for all time in the work of establishing the existence of a whole civilisation which existed in the Mediterranean 4,000 years ago.

Ronald Burrows should not have died so young. At 52 he was producing work in the very ecstasy of his form. He was incredibly, almost challengingly young, and vigorous in his appearance and in his activity, yet mature in quality and achievements. We shall never see all the final touches he was engaged in adding to still another revised edition of *The Discoveries in Crete*; yet incomplete as they are—I have had the privilege of seeing them in manuscript—they will when published raise the book to a still higher plane. There is no need to dwell on Burrows' own excavations at Pylos and Sphacteria and at Rhitsona. They are known to all scholars as the brilliant work of a brave and resourceful discoverer, who never knew when he was beaten and never failed to get to the bottom of formidable difficulties. His great knowledge, clear and unerring perspective, and the infinite care with which he used them, should have been spared to us for many years hereafter.

The following articles are but one feeble manifestation of what I and thousands of others have learned from Burrows. I wish I could make a truer tribute to my great friend and teacher.]

I

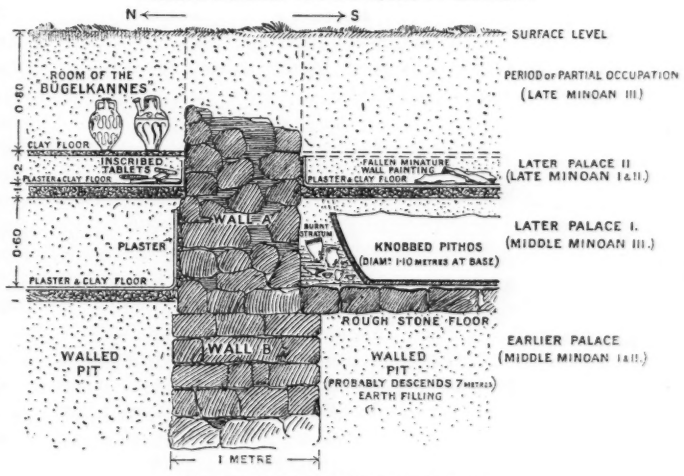
The Greek Premier, Mr. Venizelos, one of the few great statesmen in Europe to-day, comes from Crete. This fact seems to clinch in a striking way a connection which began four thousand years ago. It was in Crete, at that remote period, that the foundations of Greek and indeed European culture were laid. When Mr. Venizelos was a boy, this fact, as that of the very existence of a prehistoric Cretan civilisation, was unknown. Our knowledge of it has been almost entirely acquired since 1900. In this short time remarkable revelations have been effected by means of the spade, mostly by the spades of Sir Arthur Evans. Excavation at Knossos, Phaestos, and other sites in Crete has disclosed, not merely the existence of a people whose form of civilisation was the earliest in Europe, but their daily life, games, amusements; their art, religion, writing—though hardly yet their language; their physical characteristics, dress, the homes they lived in. A huge palace, as big as Buckingham Palace, has been unearthed at Knossos. It has a drainage system which an eminent Italian archæologist has described as "absolutely English," and which certainly anticipates the hydraulic engineering of the nineteenth century.

If turning in one's grave can be anything but a figure of speech, Charles Kingsley must have had a restless time in the last twenty years. In *The Heroes* he was writing what he himself described as a "fairy story" for his children. We know now that, in many ways, he was unconsciously writing history. When, for instance, he said that the palace of King Minos at Knossos was like a marble hill, he was unaware that there actually lived a King Minos in Crete, that his palace stood on a hill at Knossos, and that it was built, if not of marble, at any rate of stone.

It is astonishing to reflect that up to the last half-century the whole culture of classical Greece was regarded as an original thing, springing suddenly into a glorious existence. The sculpture and architecture, philosophy, oratory, and drama of the fifth century B.C. were accepted as the spontaneous first-fruits of Greek genius. The history of Greece went back only to the eighth century; beyond were the Dark Ages and nothing. It was true that before Æschylus, Sophocles, and Euripides there had been the shadowy poet Homer. He had sung of men and deeds which seemed to echo from those Dark Ages. But he certainly, so we thought, was the beginning of all things. He has now been shown to have been the end of a good many things.

Ignorance of the real beginnings of Greek civilisation becomes remarkable when one recollects how much was known of other origins in the Near East. In Egypt and Babylonia the old traditions had been passed on by later generations to Greek writers, who preserved for us, no matter how imperfectly, the necessary connecting-links. But the corresponding phase of Greek civilisation was completely shut off; there was no suspicion even of its existence. The complacent acceptance as myths—which is the same thing as the tacit and complete disbelief—of the epic stories which centred round Agamemnon and the Homeric heroes was never challenged up to the middle of the last century. "To analyse the fables," said

STRATA SECTION FROM PALACE OF KNOSSOS.



(From R. M. Burrows's *Discoveries in Crete*.)

the historian Grote,[1] "and to elicit from them any trustworthy particular facts," would be "a fruitless attempt."

Such was the outlook of Grote's contemporaries. It was an outlook that was destined to be revolutionised in a simple way. A poor boy named Schliemann had learned these Greek stories from his father, and his child's instinct told him they were literally true. He determined to find the walls of Troy. Late in life, after hard saving, he had money enough to put his faith to the test. He went to Hissarlik, the spot in Asia Minor where the town of Troy was said to have stood. He dug into the earth, and buried walls were his reward. They proved in the end, however, to belong not to the Homeric city, as Schliemann naturally thought, but to another which had existed on the same site a thousand years earlier—he had dug within

[1] *History of Greece* (2nd ed., 1849), p. 223.

and through the Homeric walls without seeing them. From Troy he went to Mycenæ and Tiryns on the Greek mainland, and the sum of his achievement was the definite disclosure of the "Mycenæan" civilisation, which, as we now know, flourished from about 1400 B.C. to 1100 B.C. He thereby justified his faith in the historic background to the Homeric poems. One can readily imagine the excitement which accompanied such discovery; as when Schliemann sent a telegram to the King of the Hellenes announcing that he had found the tomb of Agamemnon at Mycenæ. One almost wishes it had been literally true, as Schliemann at the time thought it was. In any case, he laid the foundations for the whole structure of modern prehistoric research.

Prominent in that work of research has been the opening up of Crete. The discoveries of Sir Arthur Evans and other excavators—British, American, Italian—have proved that the Mycenæan culture revealed by Schliemann was itself only a late and even decadent phase of a great Mediterranean civilisation which centred round Crete.

II

The primitive Ægean people played a great part in the activities of the Near East. This part lasted through several thousand years, and the scene of its action embraced every shore of the Eastern Mediterranean. Crete was a land, as Homer[1] says, "in the midst of the wine-dark ocean, fair and rich, with the waters all around." It was the natural centre towards which the mainlands of Greece, Asia Minor, and Egypt converged, especially as its irregular coast afforded good harbours for the small ships of that remote time.

The first settlement of man in Crete took place at Knossos, in the later or "Neolithic" Stone Age. This fact is established by the nature of the relics found at the lowest level in the excavations, the level which represents the earliest period in time. Phaestos, on the south side of the island, received its first inhabitants at a later date—a fact for which we are indebted to the pottery that has been discovered there. The establishment of this fact is indeed a typical instance of the great value of pottery as archæological evidence. The earliest ware found at Knossos is unornamented; the next is improved by "incised lines"—that is, lines cut in the clay with a pointed instrument and often filled in, for greater effect, with a white substance. At Phaestos, on the other hand, the pottery found lowest down is already in this second stage in its artistic evolution, the inference being that the men who settled there took the art with them at the point to which it had been developed by the Knossians.

After the "Stone" Age came the "Bronze" Age. Men realised that not stone, but a mixture of copper and tin, provided the best material for instruments. A picturesque touch is added to this discovery by an Italian archæologist, Angelo Mosso, who in *The Dawn of Civilisation* gives reason for believing that, even at so remote a period, the tin was brought to Crete from Cornwall. He goes so far as to point out the actual caravan route by which the tin was transported! It was during this Bronze Age, which lasted about 2,000 years, that Cretan civilisation reached its highest level. Sir Arthur Evans has given to it the picturesque name "Minoan," and has divided it into three stages—Early, Middle, Late—each with three subdivisions. Early Minoan I (E.M. I) begins about 2800 B.C., Late Minoan III (L.M. III) ends about 1000 B.C.[2] These nine periods are a happy play upon "the nine seasons" during which Homer[3] speaks of King Minos as reigning in Knossos: "And in Crete is Knossos, a great city, and in it Minos ruled for nine seasons, the bosom friend of mighty Zeus." The term "Minoan" should be carefully distinguished from "Mycenæan." After Schliemann's discoveries at Mycenæ and Tiryns, the term "Mycenæan" was used in a general sense, to cover the whole prehistoric Ægean civilisation; but now that Crete has put Mycenæ into its right perspective, the term "Minoan" is used to indicate the earlier and greater phase, while "Mycenæan" merely covers the latest phase; the whole being designated "Ægean" or "Mediterranean." There is, to complete the nomenclature, a further epithet, "Cycladic," which is sometimes substituted for "Minoan" when one speaks exclusively of the island sites outside of Crete.

With the fall of Knossos, which took place shortly before 1400 B.C.—I again adopt Dr. Burrows's dating—the centre of influence in the Ægean passed over from Crete to the mainland of Greece, and the true "Mycenæan" period started. Thereafter followed the Dark Ages, which themselves immediately preceded "historical" Greece. Recorded Greek history begins about 800 B.C.

(To be continued next month)

Dr. R. R. Marett's important book, *Psychology and Folk-lore*, discusses the methods of the study of man, and should be of great interest both to psychologists and students of folk-lore, while it will assist in interpreting history as the expression of our common human nature. The book is published by Messrs. Methuen at 7*s.* 6*d.* net.

The Lure of the Map is the title of a series of essays on the literature of travel, the relation of travel and romance, and the fascination of the map. The book is by W. P. James, and Messrs. Methuen are the publishers.

[1] *Odyssey*, xix, 172.

[2] See *The Discoveries in Crete*, by Dr. Ronald M. Burrows, p. 98.

[3] *Odyssey*, xix, 179.

Immunity and Plant Diseases

By Geo. C. Gough, A.R.C.Sc., B.Sc.

IMMUNITY from, or resistance to, a disease in animals is an old tale, and a vast amount of literature in many countries testifies to the work that has been done on the subject. Toxins and antitoxins are now almost household words. The immunity of plants to disease has only recently come into the realms of scientific research, but with animals it is now possible to inject a serum containing an antitoxin which will give immunity to a specific disease—recent notable examples being diphtheria and tetanus—such serums being prepared in large quantities and on a commercial scale.

Thousands of pounds are lost yearly by the action of plant and animal parasites on plants, and at least 10 per cent. of each crop is lost by such parasitic action. It is evident, therefore, that a considerable increase of food could be obtained if such diseases could be held in check. Generally speaking, animal pests are more easily controlled, whether naturally by means of their parasites, or by spraying the plants with some poisonous wash.

On the other hand, diseases caused by fungi are not so readily checked, as in very many cases the first signs of their presence are the wilting and death of the plant.

It would therefore be of the greatest service if it were possible to confer immunity from disease on plants. Our knowledge of the cause of immunity in plants is so slight that the question of the preparation of antitoxins is not a practical proposition at the present time, and even if it were, it would be seldom possible to apply them to the plants. What little knowledge we have suggests that immunity may be due to various causes, such as the death of the germ tube of developing spore of the causal fungus on entering the cells, the presence of certain salts or acids, or even the amount of bloom produced on a leaf. In the latter case resistance is only due to the fact that water, in which spores can develop, rolls off.

Fortunately this natural resistance to certain diseases in many varieties of plants can be made use of by hybridists who have been able to produce immune varieties.

It is regrettable that such natural resistance is often associated with poor cropping or feeding qualities, and the efforts of breeders are put forward to associate immunity with other good qualities. In this connection mention must be made of Professor Biffen's efforts to associate immunity from rust[1] in wheat with a good cropping "strong" variety, as these have met with gratifying success. At least two of his varieties are now being grown commercially.

In Australia, Farrar has produced wheat hybrids which are rust-resistant, and one of these is being grown by farmers; while in America, Norton has produced a rust-resisting asparagus, which is grown on a commercial scale.

Pure selection has been used to a considerable extent in the United States. A plant is noted in a field as being resistant to some epidemic disease which has killed all its neighbours. The progeny of this is then subjected to attack by the same disease, and by a similar weeding-out process a strain is produced which is mainly, if not entirely, resistant to the disease in question. Thus strains of cabbage and tomatoes resistant to wilt disease have been raised in this fashion.

It is important to realise that the resistance thus conferred is like that amongst animals, only to a specific disease, so that a plant or animal may be rendered immune to one disease only to fall a victim to another.

The most important instance of immunity is that of certain potatoes from a virulent disease known as Wart Disease. This disease has been known for some years as a soil pest in certain districts, and is gradually spreading over Great Britain. It is caused by a lowly fungus which may lie in the soil for many years, and as no cure is known for it, it continues to attack potatoes, if planted year after year, causing ugly outgrowths on tubers and stalk. In very few years warts only are found, and no potatoes are formed. The disease is so destructive and widespread that it has been made notifiable by the Ministry of Agriculture, and the movement of seed potatoes from infected districts is regulated. In 1908 an inquiry was made by the author, who noticed that certain varieties were grown by cottagers and others in infected land without being attacked by the fungus, and this led to trials of different varieties in infected soil.

Official trials are now conducted every season by the Ministry, and as a result the list of varieties which have proved immune from this disease is now over 100. Although the reason for it is still unknown, the immunity is absolute, and no variety which has been officially classed as immune has taken the disease.

A striking experiment in this connection is to plant side by side in infected soil tubers of Great Scot and Arran Chief (or King George and British Queen), so that plants grow up intertwined. The tubers are similar, and would not be distinguished by the ordinary person. Yet on lifting the crop at the end of the

[1] Rust, a fungus disease showing first as rusty streaks on leaves of cereals, and causing a great reduction of crop. Many other plants have their "rusts."

season, the Great Scot will produce a good crop, free from any sign of warts, while the Arran Chief may only show warts and not a sound tuber. In the same way the King George will be free and the British Queen attacked.

So important and so certain is the immunity that the administration of this disease by the Agricultural Boards in the British Isles is based on the fact, and where the disease is present only immune varieties of potatoes may be planted. Raisers of potatoes are therefore exerting every effort to produce such resistant varieties having the good cropping and other qualities of those in commerce at the present time, and considerable success is being achieved. If a potato immune both from Wart Disease and ordinary potato disease or Blight (Phytophthora) could be raised with the cropping qualities of some of the ordinary commercial potatoes such as Up-to-date and King Edward, the food-supply of potatoes in the British Isles would be increased by at least 20 per cent. This ideal is not beyond the bounds of possibility, as, although no potato is immune from Blight, several—for example Flourball, Champion, and Templar—are immune from Wart Disease and largely resistant to Blight. They have disadvantages which militate against their general and commercial use, but breeders hope to get rid of these, while still maintaining their resistance to disease.

The literature on Immunity in Plants is very scanty, and no book is published on the subject. A recent general account is that by Dr. Butler in the *Proceedings of Second Meeting of Mycological Workers in India*, 1919. Reference may also be made to a paper by Otto Appel in *Science* for May 28, 1915. As regards Wart Disease, a full bibliography is given in the author's paper in the *Journal of the Royal Horticultural Society*, June 1920.

The Revival of Learning and the Capture of Constantinople

By R. B. Mowat, M.A.

Fellow and Assistant Tutor of Corpus Christi College, Oxford.

THE Revival of Learning is the most momentous fact in the history of Europe. With the decline and fall of the Roman Empire in the fifth century A.D., a great part of the literature and learning of the ancient world disappeared for centuries. The "Dark Ages" ensued, when life was very insecure, and education, except within the walls of certain fortunate monasteries, scarcely existed. The "Feudal System," according to which every man had a fixed place in the community, under a master, saved society in the Middle Ages, but at the expense of all political, social, or intellectual freedom.

The Middle Ages may be considered to begin, and the Dark Ages to have ended, with the coronation of Charlemagne as Emperor at Rome in A.D. 800. From Charlemagne's time onward, the rôle of the Church in moulding the manners and minds of men becomes more and more effectual, so much so that the eleventh and twelfth centuries have been called "the Ages of Faith." It was indeed faith, rather than reason, that ruled in the Middle Ages; and although the services of men like St. Anselm or St. Thomas Aquinas to the human intellect must always be recognised, it still remains true to say that the Middle Ages were marked by a certain rigidity; every man was definitely fixed in his class, in his profession, in his corporation; the use of the human reason was strictly limited, and investigation and argument were conducted according to fixed rules. One of the greatest and most open-minded of the Mediævalists asserted that the human intellect was not meant to be able to discover everything; for if it had been able to do so, there would have been no scope for the life of Christ in the world:

> State contenti, umana gente, al *quia*;
> Chè, se potuto aveste veder tutto,
> Mestier non era partorir Maria.
>
> (Dante, *Purg.*, iii. 37.)

> Seek not the wherefore, race of human kind;
> Could ye have seen the whole, no need had been
> For Mary to bring forth.

During this long mediæval period, this time of intellectual rigidity, the greater part of classical literature was not studied; indeed, many of the classics which we now have were not at that time known to exist at all—such as Cicero's *Letters to Atticus*, of which the manuscript was not discovered till 1345. The great secular book of the Middle Ages was Virgil's *Æneid*. Comparetti, in his work *Vergil in the Middle Ages* (*Virgilio nel medio evo*), has shown how this poet was regarded as a prophet, a grammarian, a wizard, and as a universal compendium of learning.

Thus the learning of the Middle Ages was chiefly derived from Latin works, and from only a restricted number of Latin works. Something was known of Greek literature, but only through translations—some of Aristotle's works, for instance, were known through Arabic translations, which in turn were rendered into Latin. It was not merely, however, that Hellenic literature had disappeared; the Hellenic spirit, the spirit of freedom and inquiry, had also been forgotten. The Middle Ages ended when classical

studies, and particularly the study of Greek literature, revived: then the veil was lifted, and the new birth, the Renaissance, of Europe took place.

The date of this Renaissance has been conventionally placed at the year 1453, when Constantinople, the capital and last stronghold of the "Greek" or "Byzantine" Empire, fell before the Turks, under the Sultan Mohammed II. It has been assumed that many Greek scholars, bearing with them ancient Greek manuscripts, fled from Constantinople in the face of the Turks, and spread classical learning throughout Western Europe. To support this theory, however, practically no facts can be advanced; the fall of Constantinople makes a landmark in European history, but its influence upon the Renaissance appears to have been comparatively little. By closing the land-routes to the East, the Turks may have helped to turn men's minds towards finding out the ocean-routes in the West, but they cannot be said to have had any part in producing, by their misdeeds, the revival of learning. This revival, and its consequent freeing of the human intellect, had already been going on for more than a century when Constantinople fell.

Knowledge of the Greek tongue was never quite dead in Italy at any time in the Middle Ages, because in the extreme south of Italy, in Calabria, the towns had been originally colonised by Greeks, and the use of Greek speech had never since died out. Moreover, until the middle of the eleventh century the Byzantine Empire retained some shreds of its authority in Italy, and throughout the rest of the Middle Ages, diplomatic communications and personal missions between Italy and Constantinople were quite frequent. Greek manuscripts, copied by scribes in Byzantium, were conveyed over to Italy as presents, or perhaps for sale. Petrarch, who flourished in the middle of the fourteenth century, possessed a copy of Homer, which came from Byzantium; he was unable to read it, however. Another great contemporary Florentine, Boccaccio, both possessed and could read Greek classics. It was in the year 1360 that, owing to the efforts of Boccaccio, a chair of Greek was instituted at Florence, the first professor being Leo Pilatus, a Calabrian who had learned Greek as his mother-tongue in South Italy. He was induced by Boccaccio to translate the *Iliad* into Latin. Mr. A. C. Clark, the Corpus Professor of Latin at Oxford University, who has been lecturing on "Scholars of the Renaissance," states that, if any specific date must be given for the beginning of the scientific study of Greek, it should be the year 1396, when Manuel Chrysoloras, an accomplished scholar from Constantinople, began teaching Greek in Florence. His career as a teacher and as a man of learning lasted till 1415, by which time classical studies may be said to have been re-established in Western Europe.

The Revival of Learning, however, was not wholly Greek. In the middle of the fourteenth century there was also a great revival of Latin studies. Petrarch, who lived from 1304 to 1374, was a Latinist of the highest quality; it was he who discovered the above-mentioned manuscript of Cicero's *Letters to Atticus*, at Verona, in 1345. But the greatest scholar of the Early Renaissance was Poggio, who was born in 1380 and lived till 1459. His most important work for classical scholarship was done in 1414 and 1415, when he was one of the Papal Secretaries at the Council of Constance. In the intervals between his attendances at the Council, he visited the chief monasteries of Switzerland and Burgundy, and also Cologne, and searched their libraries. It is to his initiative and energy that we thus owe the rediscovery of many classical manuscripts, in particular a number of Cicero's speeches, which had lain forgotten for centuries in the monastic libraries. It was about fifteen years after Poggio had discovered these manuscript treasures that Laurentius Valla began his epoch-making work in critical scholarship; his method of examining texts and manuscripts led to the separation of the genuine from the spurious. He is best known for his exposure of the "Donation of Constantine," the supposed fourth-century grant of temporal dominion to the Papacy.

Thus the Revival of Learning, the modern zeal for education and inquiry, must be dated from the beginning of the "Later Middle Ages," from about the early years of the fourteenth century, if not earlier. Some of its greatest achievements had taken place long before Constantinople fell, in 1453, and it cannot be proved that this event had any particular influence upon the course of the Renaissance.

THE REVIVAL OF LEARNING IN THE LATER MIDDLE AGES

The Early Renaissance may be still studied with advantage in Pater's *Renaissance* and Symond's *Renaissance in Italy* (1897). Creighton's *History of the Papacy* (1882) and Lindsay's *History of the Reformation* (1908) are classical works. Scartazzini's *Companion to Dante* (1893), translated by Butler, gives good information on Dante's learning. The classical work on the early history of Humanism is Voigt's *Die Wiederbelebung des classischen Alterthums*, which has been several times re-edited. The history of discoveries of manuscripts in the Later Middle Ages is given by Walser in *Poggius Florentinus: Leben und Werken* (1914), and in Sabbadini, *Le scoperte dei codici latini e greci ne' secoli* xiv *e* xv, 1905. The standard work on the history of scholarship is Sandys, *A History of Classical Scholarship* (1908). Mowat, *The Later Middle Ages* (1917) is a general account of the period.

Popular Chemical Dictionary. By C. T. KINGZETT, F.I.C. (Baillière, 15*s.* net.)

The Origins of Mexican Mythology

By Lewis Spence

Author of "The Civilisation of Ancient Mexico," "Myths of Mexico and Peru," etc.

THE mythology of the Aztec people of Ancient Mexico has been unaccountably neglected by British students of Comparative Religion. German, American, and French scholars have been quick to grasp its importance and significance, and their researches have succeeded in placing it on an equality of standing with the faiths of Egypt and Babylonia. It is singular that British scholarship, which has done more than any other for the advancement of the science of Comparative Religion, should have disregarded a source from which so many striking illustrations of the development of religion can be drawn.

British apathy towards the subject of Mexican Archæology and Mythology would seem to arise out of the rather unusual difficulties which have hitherto beset the initial efforts of those who desire to pursue its study. The languages of Mexico and Central America are complex and not easily mastered, and the works of the older Spanish authorities upon myth and ritual are numerous, expensive, and not easily obtained unless in the best-equipped libraries.

But supposing these obstacles to be overcome by the enthusiastic student, he still finds himself opposed by others of even greater magnitude. He must make an exhaustive study of the native calendric and hieroglyphic paintings or codices, which at the first bewildering glance appear as a mass of writhing figures and inextricable symbols, executed with what would seem to be a total disregard of all method. Towards the comprehension of these, he will find a certain guidance in the works of Professor Eduard Seler, of Berlin, who has laboriously described and annotated them. But, even so, he will meet with many disheartening admissions of ignorance on passages of obvious importance, and, if he possess independence and initiative, he will, in the event, prefer to resort to a first-hand examination of these manuscripts.

However valuable the student may find a perusal of the painted manuscripts of the Ancient Mexican peoples, he will soon discover that their contents are, for the most part, limited to a record of the periods at which certain religious festivals were celebrated. These are usually accompanied by pictures of the gods, which will assist him to a comprehension of their general appearance, costume, and the insignia which illustrate their deeper significance. Here and there, too, he will find pictorial representations of myths and festivals. But it is rather from the prolix and elaborate works of the Spanish Colonial writers of the sixteenth and seventeenth centuries that he will first extract the material which will enable him to form a just estimate of the religion of the Ancient Mexicans. In the writings of Sahagun, Torquemada, Mendieta, and others, and the annals of Spanish-speaking natives in particular, he will encounter those facts which will help him to solve the riddles of the manuscripts.

During the last few years of a long apprenticeship to the study of Mexican religion, my endeavours have been directed to smoothing the progress of those who will come after me, and I hope to complete shortly a volume, somewhat in the nature of a handbook, bringing together all available data concerning each of the gods, especially as regards costume, symbols, etymologies, myths, and representations in painting and sculpture. But in such a brief paper as this I must confine myself to that phase of it which I have recently been considering more especially—the origin of the more important of the Mexican gods, i.e. the original forms in which these appear to have presented themselves to the Aztec mind.

In course of time one outstanding fact will bulk before the student to the diminution of all others. The religion of Ancient Mexico, he will come to see, was originally developed out of an urgent local need —the need for rain. At the period when Cortéz and his Spanish cavaliers invaded Mexico, the native faith of that country was nothing more than a vastly elaborated rain-cult, similar in its general tendency to that which still prevails among the Pueblo Indians of New Mexico, yet broader in outlook, more complex, and higher in moral endeavour, although stained with the cruelties of human sacrifice. The necessity for rainfall, by which alone the parched soil of Mexico could be rendered fit for the growth of maize, practically obscured every other consideration in the native mind. Once that salient fact is grasped, much will have been done towards the understanding of Mexican religion as a whole.

At a late stage of its development, practically all the gods of Mexico came to be included in the great national rain-cult, but in some cases their early forms show signs, if I am not mistaken, of tribal or local origin quite foreign to it. This is especially the case with Uitzilopochtli, who until now has been labelled as a "war-god," and whose name has been translated "Humming-bird-to-the-left" or "Humming-bird-of-the-South." I believe that this god was at first a personification of the maguey plant (*Agave americana*). A certain variety of this plant, so common in Mexico, was known to the Aztecs as "beak of the humming-bird," probably because of the resemblance its long spiky thorns bear to the sharp beak of that graceful

little creature, which suspends its tiny web-like nets from the leaves of the plant in question. I find in an old manuscript by a native writer that another of the names by which the god was known was "Snake of the Maguey," and still another and better known title of his was Mexitli, or "Hare of the Maguey," from which one of the districts, and later the whole city, of Mexico took its appellation. Elsewhere he is called "Thorn that speaks oracularly," and the maguey plant is one of the elements of the hieroglyphs which represent his name. On the day of his movable festival, too, says Friar Sahagun, the proprietors of the maguey plantations and the publicans who sold the *octli*, or intoxicating juice extracted from the agave, cut their plants in the belief that they would yield more abundantly if tapped at such an auspicious time, and the first of the *octli* was afterwards offered to the god.

The etymology of the name Uitzilopochtli also assists the theory that he was developed from some idea connected with the maguey. The first part, *Uitzil*, is thought to be derived from *uitzilinin*, "humming-bird." *Opochtli*, while it certainly means both "left" and "south," as many authorities state, also signifies "wizard," "as," says Torquemada, "some folks believe." For the word "left," in Mexican, as in Latin, also implies "sinister," "inauspicious," "malign," therefore "magical" or "wizard-like." Sahagun calls Uitzilopochtli "a necromancer and friend of disguises" (that is a shape-shifter); and we have already seen that the idea of oracular speech was connected with him probably because of the intoxicating nature of the juice of the plant he personified, which, in its effects, also appealed to the native mind as serpentine or venomous. I therefore believe the name Uitzilopochtli to mean "Humming-bird Wizard." The humming-bird, which builds its nest in the maguey and is seen to issue therefrom, would come to be regarded as the living spirit which inhabited that plant. But it is possible that a certain amount of confusion arose between the words *uitzilinin*, "a humming-bird," and *uitztli*, "a thorn," and this may have assisted the belief that the god took bird-shape. Indeed, the name may originally have meant "the Thorny Wizard," and have had reference to the plant alone, later (by a process of punning or "disease of language" well known to students of mythology) taking the form referred to above.

The beginnings of the god Tezcatlipoca, whose name means "Smoking Mirror," and who has been labelled a "wind god," are quite as rudimentary. I believe him to have been a personification of obsidian, a kind of flint especially sacred to the Ancient Mexicans, as it provided the sacrificial knives used by the priests.

[*Continued on p.* 184

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Acosta states that Tezcatlipoca's idol was made of obsidian, and he is represented in one of the manuscripts as wearing obsidian sandals (footgear often indicates the nature of a person or deity in Mexican heiroglyphic painting). He was certainly the god of the sacred obsidian knife of sacrifice, and he is occasionally symbolised by that implement, which sometimes takes the place of one of his feet. I believe, too, that the net-like garment worn by this god above his other attire is a development of the mesh-bag in which Mexican hunters carried flints for use as spear- and arrow-heads.

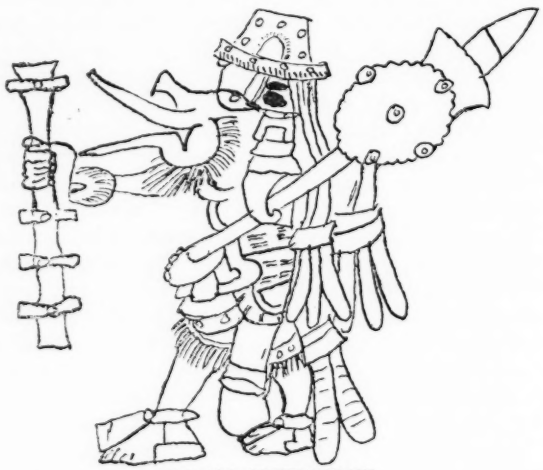
But there is a much stronger connection between Tezcatlipoca and the obsidian stone. From this mineral mirrors were cut and polished, not only for the ordinary purposes of the toilet, but for the use among wizards and sorcerers as aids to divination. Into the depths of these the wizard peered to read the riddles of the future, just as the modern crystal-gazer "scries" in her polished globe. One variety of this stone was called *tepochtli*, or "wizard-stone," from which, it seems to me, by a process of etymological confusion, Tezcatlipoca may have received one of his minor names, Telpochtli, "the Youth." Acosta and other writers tell us that this god was represented with a magical mirror called *tlachioloni*, "his glass to look in," in which he was able to witness the deeds of all mankind, precisely as the priests were supposed to do.

Tezcatlipoca is frequently referred to as "a shadow," "a ghost," and this aspect of him, I believe, refers to the misty shapes seen by the sorcerer in the magic glass. Thus, from the shape beheld in the seer's mirror, Tezcatlipoca came to be regarded as the seer himself. The wizard-stone became personalised and developed into a god, and its reflections became his attributes.

But Tezcatlipoca as the obsidian also came to be thought of as one of those magical stones by the agency of which great wind-storms can be raised, and of which there are numerous examples in all mythologies. He has been identified with the Central American god Hurakan, from whose name we get the word "hurricane." He was therefore thought of as a god of wind. But it was chiefly through the fear inspired by his magical prowess that he came to be regarded as chief deity of the Mexican pantheon. His name, "Smoking Mirror," arose, I think, from the cloudy appearance which obscures the surface of a scrying-glass when one has gazed into it for some time.

The god Quetzalcoatl, regarding whose significance there have been many striking differences of opinion, has at one time or another been identified with the wind, the sun, the moon, the planet Venus, and the apostle St. Thomas! His myth, of which there is an embarrassing number of variants, tells of his arrival in one part or another of Mexico or Central America, where he laboured to civilise the people and to introduce the arts of agriculture and settled existence, founding the culture known as the Toltec, which flourished at Tollan. His mission accomplished, he was driven from the country by the "magician" Tezcatlipoca.

In my view, the physical phenomena which occur in connection with the courses of the winds typical of the Mexican plateau provide by far the most simple and natural explanation of the nature of the god Quetzalcoatl. From April or May to the beginning of October the trade-wind blows in a north-easterly direction from the coast over the plateau, bringing with it abundance of rain and accelerating vegetable growth. At the end of that period, however, it is invariably modified by the local monsoon, which interrupts it over wide areas, or in certain districts



THE GOD QUETZALCOATL.

From the author's *The Civilisation of Ancient Mexico*, by kind permission of the Cambridge University Press.

invades it in violent cyclonic storms, dissipating its energies and altering its course from north-east to south-west. Quetzalcoatl resembles the gentle trade-wind which ushers in the growth-making rains. His reign of peace, plenty, and fertility over, he comes into opposition with Tezcatlipoca, who represents the monsoon, and who chases his rival from "city to city," ravening at him like a tiger (says Mendieta), and at last hustling him out of the country. This attempt at elucidation refers, of course, to what seems to be the earliest form of his myth. Its later forms are surprisingly complex, but are all capable of being referred back to the original nature-story. The etymology of his name, too, which is usually translated "Feathered Serpent," seems to me to indicate the

water carried by rain-clouds, the serpent being the symbol of water in America as elsewhere.

These remarks must not be taken as applying to the later and more complicated developments of the gods to which they have reference, but to their earliest forms alone.

Aerial Warfare in Ancient India

By Ikbal Ali Shah, M.R.A.S., F.R.G.S.

In the ancient literature of the East, we come across many allusions to the fact that the science of aviation was conceived in India as early as 500 B.C. In the carved rocks of the Southern Indian caves is held the key to this secret art of pre-Brahmanic age, just as the Pyramids of Egypt and the Topes of Kashghar are the respositories of an artistry more than half forgotten. The figures incised in the caves of Ellora do not give us any satisfactory account of ancient Hindu aerial machines—their plan of construction or what they could do—but those images lend colour to the statements made in the traditional books of the Brahmans regarding the use of "flying carriages" in the earliest period of Indian history.

These references are encountered notably in the Ramayana and Mahabharatta. These works are by no means confined to one period of time, but, like most sacred books, they consist of materials of different dates, illustrating the progress of the social and religious evolution of the Brahmans. The great Hindu epics were written to celebrate the exploits of kings and the conflicts of an internecine war. References to flying during that period are very clearly indicated in the Ramayana. In this stirring poem, which was compiled about the year 500 B.C., we learn that Rawun, a King of Ceylon, used to fly over his opponents' armies and not infrequently caused them severe loss.

The writer of that book mentions, further, that after a fierce struggle between the Brahmans and the King of Ceylon, in which Rawun was defeated and slain, his wonderful "flying carriage" fell into the hands of Ramchander, the Hindu chief, who flew in it from Ceylon to his capital at Ajudhia, in Northern India.

Apart from the notices of flying in the semi-religious literature of India, we find that the historical poets of those distant times also celebrated the subject. The greatest of the ancient Hindu poets, Kali Das, treats of the aerial journey of Ramchander in a heroic

[*Continued on p.* 186

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poem entitled " Ragho-Buns." A lesser poet, too, who flourished some 200 years later, in a description of the war between rival Hindu chiefs led by Risho and Arjan, speaks of a " flying carriage " which did much to hamper the movements of an army. In the Mahabharatta mention is made of a king presenting a brother monarch with a flying machine as a token of friendship. Also in Puranas one reads of a " huge flying carriage possessed of the power of travelling by itself."

In perusing the Sanskrit classics one comes across numerous aeronautical terms. Some of the more interesting of those may, perhaps, be quoted:

Vaman-yanu, meaning: To propel a flying carriage.
Vaman-Chirya, meaning: To fly in a flying carriage.
Vaman-Perbhoot, meaning: A procession of flying carriages.
Vaman-Arj, meaning: One who works a flying carriage (an aeronaut).

Such phrases are very frequently met with in the Hindu epic writings. It is generally admitted that, when a language is in process of formation, new words and terms are coined as the necessity arises. Is it venturing too far, therefore, to assert that, if flying machines had not existed in Ancient India, such phrases could surely never have come into common use? Why, then, do we find them so deeply embedded in old Sanskrit?

That Rawun and other epic heroes were not without means to strike a shrewd blow at an invader from the air is manifest from further allusion in the Ramayana, which described the " explosive torches " that they hurled from their machines upon the heads of their enemies.

The manner of making these primitive bombs is treated of in several ancient manuscripts which exist in India. There are, it is well known, recipes for making fireworks both for purposes of destruction and purposes of pleasure. Rural poets have rendered these recipes into colloquial verse, and in the Indian villages which lie beyond the railway zone there are few rustic youths who cannot recite these ancient formulas. The pandits—priests—state that these recipes are almost contemporary with the great epic poems.

The method of manufacturing these " aerial torpedoes " was as follows: a pasteboard cylinder about two feet long was filled with charcoal, saltpetre, and nitre, mixed with nails and sharp pieces of glass. The fuse was of coconut fibre, which was ignited before the " bomb " was cast.

According to common usage, the verses which refer to these fireworks are to be recited as sacred passages. Some priests even go so far as to prohibit the vulgar from learning them. Certain rites and ceremonies are supposed to be celebrated prior to the manufacture of these explosives, and occasionally the village pandit opens the proceedings in person. All these facts afford strong presumptive evidence as to the antiquity of the art of fireworks in India; and those who are familiar with the religious traditions of the Hindus cannot deny that the practice owes its sanctity to its alleged association with the wars between the Brahmans and the unfaithful King of Ceylon.

In ancient Sanskrit records we have, then, not only a most interesting record of conception of aircraft in India in 500 B.C., but we are also afforded a glimpse of their activity. It would seem that the modern phase of aeronautic development is only a replica of more ancient effort, and here as elsewhere history has repeated itself.

The Modern Uses of Rubber

A STOCK phrase is that " there is nothing like leather," but at the present day this should be changed into " there is nothing like india-rubber," as never at any time have its uses been so varied and its commercial demand so great. One sure sign of an article's utility is the number of substitutes placed upon the market, and of substitutes for rubber there have been scores, not one of which possessed all the qualities of the genuine article; and although very many nearly approached it, yet they were short of one or more essential features. Rubber is a curious substance, much more so when manufactured than in the raw state, the quality which so far renders it unique being its high degree of elasticity, which it shows to the best advantage in the rubber threads used for those textiles known as elastic. Motor tyres, waterproof fabrics, hose piping, and tobacco pouches are all dependent on that elastic quality of the rubber, which causes it to spring back to its original state; whilst a host of other articles, no less useful, are made from the hard form of it commonly termed vulcanite. Owing to the many uses to which rubber is now put, there is a considerable demand for old rubber materials, such as worn-out motor tyres, door-mats, tubing, etc., all of which are utilised again for something after the style of working up shoddy into fresh material.

Existing as a natural gum in the stem or trunk of a large number of tropical plants, rubber in the natural state forms a thick milky fluid which oozes out from cuts

made in the bark of the growing tree, and is collected in small tin cups which are cemented to the trunk with clay. On emerging the juice is whitish, but darkens and coagulates, with time and exposure, into a dingy brown mass. The shapes in which it is imported vary largely according to circumstances; some being in the form of round balls, known as nigger heads, and other in blocks, thimbles, cakes, and bottle-shaped masses. Chemically, rubber or caoutchouc is a complex substance and consists of several different gums. These bodies have varying degrees of solubility. Water, of course, has no action upon raw rubber, but it dissolves in a mixture of carbon bisulphide, benzene, and naphtha. No single solvent will dissolve it entirely, some of its constituents being acted upon more quickly than others by the various solvents used, and the raw substance seems to consist of a highly porous network of cells. At a temperature of 10° C. raw rubber is a solid body with very little elasticity, whilst at 36° it is soft and elastic to a high degree, and is capable of being stretched to sixteen times its length. Further increase of temperatures lessens these elastic qualities, and at 120° C. it melts. In the raw state rubber has several peculiar properties, one of which is that, after being stretched and cooled suddenly in the stretched condition, it retains its new form, and only regains its former shape on being warmed. Another striking feature is its strong adhesive capacity; this is so powerful that the raw substance cannot be cut with a knife unless the blade is wet, and freshly cut portions, if pressed together, form a homogeneous mass.

The first use of rubber gum was for waterproofing fabrics, and in 1823 a solvent was found by Charles Mackintosh which allowed a thin coating to be applied like paint. Owing, however, to its sticky nature, it made very little headway for waterproofing purposes, until, in 1839, an American named Goodyear found that a mixture of rubber and sulphur heated together produced a body very different from the raw gum, being elastic at low temperatures and free from stickiness right up to its melting-point. This discovery, known now as vulcanising, opened up an important future for rubber, and by varying the amount of sulphur, together with the heat and duration of the process, products are obtained which range from the softest flexible tubing up to the material used for making the barrels of fountain-pens and the mouthpieces of pipes. On broad lines the outline of the vulcanising process is as follows: The raw material is well masticated between hot rollers, and is incorporated with the necessary amount of sulphur; it is then pressed into moulds which clamp together and prevent any loss of shape owing to the contraction of the rubber. Heat is now applied, and, when the process is over, the rubber will be found to have taken the shape of the

[*Continued on p.* 188

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mould permanently, being now much more elastic than the raw gum, and perfectly soluble in the usual solvents. Rubber possesses great adaptability for mixing with other bodies, a fact which manufacturers are perfectly aware of, and articles solely of the pure vulcanised gum are only made for special purposes. Among the many substances which lend themselves to combination with rubber are, zinc sulphide, white lead, asbestos, litharge, chalk, hemp and boiled linseed oil. By means of judicious admixtures of these, rubber can be brought to any degree of hardness and the cost can be manipulated to the makers' if not to the users' satisfaction. Low-priced rubber articles which are required to have the life and elasticity of good rubber cannot be recommended, for the very excellent reasons that good material is expensive, and all makers must have a profit.

A popular but utterly erroneous impression is that old articles of rubber, like old brass and copper, can be "melted again." The only possible way of melting rubber is to heat it, and this entails absolute destruction, leaving only a sticky, evil-smelling oil behind it, which never again sets into the old solid form. Of course, second-hand rubber is put to many purposes, but this can only be done by rasping it into fine particles and cementing these together into a solid form with either boiled linseed oil or a little new rubber solution. Once vulcanised, rubber is proof against all known solvents; many will soften and cause it to swell up in size, but none will bring it back to a workable form; and although thousands of attempts have been made to bring it back into the same condition as before the heating with sulphur took place, they have all failed. Buyers of rubber articles will have noticed a big difference in the durability between low-priced, not cheap, goods and the standard makes, which is easily accounted for by the following facts. An unscrupulous manufacturer will buy up old scrap, say, at 2½d. per pound, grind it up and mix it intimately with oxidised linseed oil, or make a better quality by substituting a small portion of new rubber for the oil. This gives him a material which he is able to put on the market much below the price of the genuine stuff, leaving him in addition a very handsome profit. Provided the shoddy rubber and the binding material are both of the same quality of rubber, chemical analysis will not detect the fake; the only test is by actual wear, in which the difference is very speedily found. The reason why remanufactured rubber will not stand hard wear is the lack of coherence between the particles of old material, these being only held together by the merest film of new rubber, so that, instead of being a tough, homogeneous substance like new rubber, it consists of particles which readily crumble and break away. When such a binding substance as linseed oil is used, the strength is much less than rubber solution, and, owing to this oil setting into a flexible substance very like rubber in appearance, it is a favourite constituent of rubber compositions. For such purposes as door-mats, cheap shoes, rubber heels, toys, etc., the use of the resuscitated material is legitimate; but when applied to such purposes as rings for the packing of high-pressure steam-pipes, it cannot be so lightly looked upon, since in this case it constitutes a serious danger. Hard vulcanised rubber was formerly much used for insulating purposes in electrical trades, and for such purposes many of the compositions made from old or reclaimed rubber are quite effective enough, provided they do not deteriorate with time and lose their insulating property. At the present day, however, rubber for electrical purposes has been largely replaced by paper, cotton, mica, glass, etc., so that its importance to this industry has grown very much less.

Like water, rubber is "incompressible"—that is to say, its form is readily modified by pressing or pulling—but the actual bulk remains the same, and if compressed in one direction it expands equally in another. Oil or grease of any kind is a deadly enemy to rubber, which softens under its action and quickly loses its elasticity and strength. Sunlight is also destructive to it, and sets up a gradual decomposition which nothing can prevent; in fact rubber articles of every kind seem to undergo a slow change in their composition, becoming more brittle with age, and with mackintoshes the protective layers become friable and fall away. Immersion under water is the best preservative for rubber, and, as most people are aware, one day's exposure to sunlight works more mischief with a rubber-proofed garment than three months' wear in wet weather. What the chemical compound of sulphur and raw rubber is no one as yet knows; but once vulcanised the sulphur is held tenaciously, so that it cannot be eliminated by any of the agents so far available, and the reactions between the two seem to be deep-seated and difficult to follow. A fortune awaits the man lucky enough to invent a method of reclaiming old rubber or to find a substitute having all the properties of natural caoutchouc. This field of research has engaged the intellects of many distinguished chemists in the past, and is still doing so to-day. Some time ago a patent for obtaining a rubber-like body from cereals was brought out; this was based upon the chewing of corn into a sticky gum which many of us are familiar with as children, and the process was very similar to that of mastication—namely, washing away all the starchy granules until nothing was left but a grey glutinous substance. This, like many other ideas, does not appear to have met with success, as nothing further has been heard

about it. Substitutes for rubber have been exemplified for years in the case of the composition used for printers' rollers; this used to be a mixture of glue and treacle which sets into an elastic, rubber-like substance; to-day the treacle has been replaced by glycerine, but the properties of the composition are much the same. Rubber, one way or another, accompanies man throughout his earthly pilgrimage. As an infant his soother is composed of it; later on, if successful, the tyres of his motor are shod with it; and by means of a vulcanite pen he signs his cheques and other papers with it; while after nature has failed him, the foundation of his latest teeth is ubiquitous rubber.

Reviews of Books

Aviation. By B. M. CARMINA. (The Macmillan Company, 11s. net.)

The author, who is Assistant Chief Instructor at the Y.M.C.A. Airplane Mechanics School, discusses the subject both from a theoretical and a practical point of view, and his book should prove of special interest to those engaged in the construction, maintenance, or designing of aeroplanes. The book, which is copiously illustrated, deals very fully with the practical side of the question; and the index will make it valuable as a work of reference. Mr. Carmina writes best when he is giving information which has been obtained as the result of experience, such as the reasons for the choice of the various materials used, the advantages of the tractor type over the pusher, the value of giving curved surfaces to the wings, etc. His use of phrases like "horizontal and vertical stabilisers for tail and fin," although somewhat cumbrous, tends to make his work clearer; the study of aviation has been made in the past needlessly confusing by using misleading terms, e.g. planes for wings. The author is less happy when dealing with the theoretical side of the subject, partly perhaps because he has attempted the impossible task of giving explanations of a scientific nature suitable to non-scientific readers. This perhaps accounts for loose statements like (p. 12) "what we would gain in lift we would lose in weight"; and for the error in his definition of centre of pressure (p. 10), though this, in view of the fact that it is correctly defined on p. 152, may be due to carelessness.

The book is excellently printed, and the only misprint, which might give rise to confusion, is on p. 157, where the metre is stated to be 30·37 inches, nine inches too short. T. B. M. S.

The Geography of Plants. By M. E. HARDY, D.Sc. (Clarendon Press, 7s. 6d. net.)

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[*Continued on p.* 190

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subject. It contains a full description and discussion of the conditions in which plants flourish, and of their distribution in the geographical divisions of the earth. The book is well illustrated, and should be widely appreciated by all who teach or study geography, or have an interest in economic botany.

(*a*) *The Analysis of Minerals and Ores of the Rarer Elements.* By W. R. SCHOELLER, Ph.D., and A. R. POWELL. (Charles Griffin, 18*s.* net.)

(*b*) *The Mineralogy of the Rarer Metals.* By E. CAHEN and (the late) W. O. WOOTTON. (Charles Griffin, 10*s.* 6*d.* net.)

(*a*) There is need at the present time for a book which deals systematically with the complete analysis of ores and compounds containing the rarer elements. Many of these rarer elements are now so important industrially that it is time the general chemist was acquainted with a subject which in this country at least has been pursued by a few men only.

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It is a thoroughly good book. The authors appear to have taken great pains to make it complete, and to describe methods which really will work. Analysts and honours students should find it a good guide, almost indispensable, we think.

(*b*) The sub-title is a "Handbook for Prospectors," and the book is beautifully bound in leather like a presentation "Kipling." It is, unlike many books for prospectors produced in America, scientific through and through, and we imagine it will sell best to, and be appreciated most by, the class of reader which is interested in the book (*a*). This book describes the minerals of the forty elements which are classed as rare. Under each metal is given a description of its properties, its metallurgy, its industrial application; then follows a list of its ores, those of commercial importance being specially mentioned. The methods of detecting the elements in ores by analysis are next given. Each ore is described in detail, its occurrence, appearance, colour, crystalline form, etc.

The information is up-to-date, and the book is a useful and indispensable compilation.

We commend both these books. They are unique in English. A. S. R.

Man Past and Present. By A. H. KEANE. Revised and largely re-written by A. HINGSTON QUIGGIN and A. C. HADDON. (Cambridge University Press, 1920, 36*s.* net.)

The triumph of science in modern thought became assured when the doctrine of evolution was definitely accepted, for this idea has affected not only science as such, but our whole outlook upon the world. Instead of asking "What is life?" we have learned to say, "How have living creatures come to be as they now appear?"—a question which has brought us to realise that man himself must be examined and judged in the light of his past history; when at once an astonishing array of facts becomes strangely eloquent. The excellences and deficiencies of his bodily frame lead us to look upon him as the descendant of ancient forms like the Ape-man of Java and the Dawn-man of Sussex. The chipped flint arrow-heads found widely scattered over the globe bear testimony to his early activities as hunter and soldier; while the fragmentary remains of his fossilised skeleton make it possible for us to speculate upon the time of his actual appearance upon the earth. Backward races still living help us to understand the ways of primeval man, and the games, nursery-rhymes, and fairy-tales of children take us back thousands of years before the beginnings of written history.

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Invertebrate Palæontology. By H. L. HAWKINS. (Methuen, 6*s.* 6*d.* net.)

This book is an introduction to the study of fossils, and is written by the Lecturer in Geology at University College, Reading. In the first part of the book the author explains what palæontology really is, and why it is that students of it can be keen and even enthusiastic about it. Thereafter he goes on to describe the sequence of evolution as it has been unfolded in geological time. The book is well illustrated by photographs and drawings made by the author. These and the particularly lucid style of the author greatly assist to make a difficult subject clear. The book is primarily written for those who have an acquaintance with geology and zoology, and is of university standard.

Psycho-Analysis. By Miss BARBARA LOW, B.A. (George Allen & Unwin, 5*s.* net.)